May 1999

U.S. Department of Energy
U.S. Environmental Protection Agency
Idaho Department of Health and Welfare,
Division of Environmental Quality

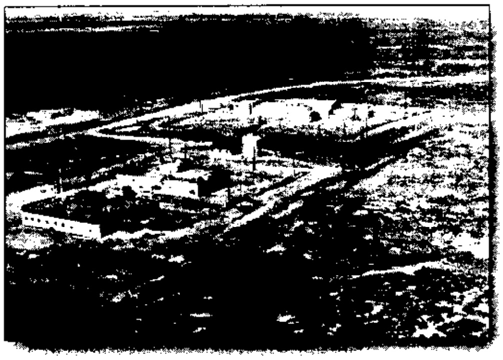
Public Comment Period May 10 - June 9

Proposed Plan for

Waste Area Group 5 - Power Burst Facility/Auxiliary Reactor Area

Idaho National Engineering and Environmental Laboratory

The PBF Reactor Area (SPERT-I) at the Power Burst Facility Reactor Area in 1993.



The ARA-I and ARA-II facilities at the Auxiliary Reactor Area in 1993.

Inside This Plan

Introduction

Between the 1950s and 1980s, research activities at the Idaho National Engineering and Environmental Laboratory (INEEL) left behind contaminants that could pose risks to human health and the environment. As part of the remedial action process, a comprehensive ***remedial investigation and feasibility study*** was initiated in 1996 to assess the risks and evaluate cleanup alternatives for sites at the INEEL's Power Burst Facility (PBF) and the Auxiliary Reactor Area (ARA).

The PBF and ARA are referred to as Waste Area Group (WAG) 5, one of the 10 waste area groups established by the ***Agencies*** to manage cleanup activities at the INEEL. WAG 5 is located in the south-central portion of the INEEL (see Figures 1 and 2). The comprehensive investigation of the PBF and the ARA is detailed in

How You Can Participate:

Read this proposed plan and review related documents in the INEEL Administrative Record (see page 32 for details).

Call the INEEL or contact the State of Idaho, EPA, or DOE project managers for more information or to schedule a briefing (see page 33 for details).

1-800-708-2680

Attend one of the public meetings to hear more, ask questions, and tell us what you think (see page 32 for details).

Comment on this proposed plan using the postage-paid comment form on the back cover or on-line using the Internet (see page 33 for details).

Note: When technical or administrative terms are first used, they are printed in ***bold italics*** and explained in the margin. Referenced documents are listed on page 31 of this proposed plan.

remedial investigation and feasibility study:
A study that identifies what contaminants are present in an area and assesses the risk they pose to human health and the environment. The study also evaluates remedial options. A comprehensive remedial investigation and feasibility study at the INEEL is the extensive final study for a waste area group that reviews previous cleanup activities, assesses combined impacts of all release sites, and evaluates the cumulative risk for an entire area.

Agencies:
The U.S. Department of Energy (DOE); the U.S. Environmental Protection Agency (EPA); and the Idaho Department of Health and Welfare, Division of Environmental Quality – the three agencies responsible for the scope and schedule of remedial investigations at the INEEL.

Administrative Record:
The collection of information, including reports, public comments, and correspondence, used by the Agencies to select a cleanup action. The INEEL Administrative Record is available to the public on the Internet and at the locations listed on page 32.

INFO The INEEL lies within the lands traditionally occupied by the Shoshone-Bannock Tribes. The tribes have used the land and waters within and surrounding the INEEL for fishing, hunting, and plant gathering, in addition to medicinal, religious, ceremonial, and other cultural uses. Under a cooperative agreement[2] between the tribes and DOE, some tribal activities continue today within the INEEL boundaries.

Record of Decision:
A public document that explains which remedy will be used at a site and why. The Responsiveness Summary contains the public comments received on the proposed actions, and the Agencies' responses to those comments.

INFO Three records of decision addressing 14 of the 55 sites in WAG 5 have been completed:

- Operable Unit 5-10 no action Record of Decision[3] addressed the ARA-01 Chemical Evaporation Pond. No action was identified. However, the site was forwarded to another operable unit (the comprehensive investigation) for evaluation of groundwater risk because of inadequate available data.
- Operable Unit 5-13 interim action Record of Decision[4] addressed the PBF-08 Corrosive Waste Sump and the PBF-10 Evaporation Pond. The sump was decontaminated and the pond was remediated and backfilled.
- Operable Unit 5-05 action Record of Decision[5] addressed the SL-1 Burial Ground. An engineered barrier was constructed over the site. This Record of Decision also documented no action decisions for 10 sites in four other operable units.

the *Waste Area Group 5 Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study* report.[1] The information from the study is used by the Agencies and the public to evaluate cleanup requirements and alternatives. The comprehensive investigation report and related documents are available in the INEEL ***Administrative Record***.

This proposed plan is based on the comprehensive investigation report. The plan summarizes the risks associated with the seven sites in WAG 5 that require remediation. For each site, it describes possible cleanup alternatives, presents the preferred alternative, and explains why it is preferred.

The Agencies identified the preferred cleanup alternatives presented in this proposed plan. Members of the public are strongly encouraged to review the proposed plan and submit comments in writing, by e-mail, or in person during the public comment period (May 10 through June 9, 1999). The Agencies will consider community acceptance of the alternatives, as indicated by the comments received, before final cleanup alternatives are selected. The public's comments and the Agencies' responses will be contained in the Responsiveness Summary section of the ***Record of Decision***, which is scheduled for completion in November 1999.

Background

The INEEL is an 890-square-mile facility operated by the U.S. Department of Energy. It is on the eastern Snake River Plain, a relatively flat, semiarid desert in

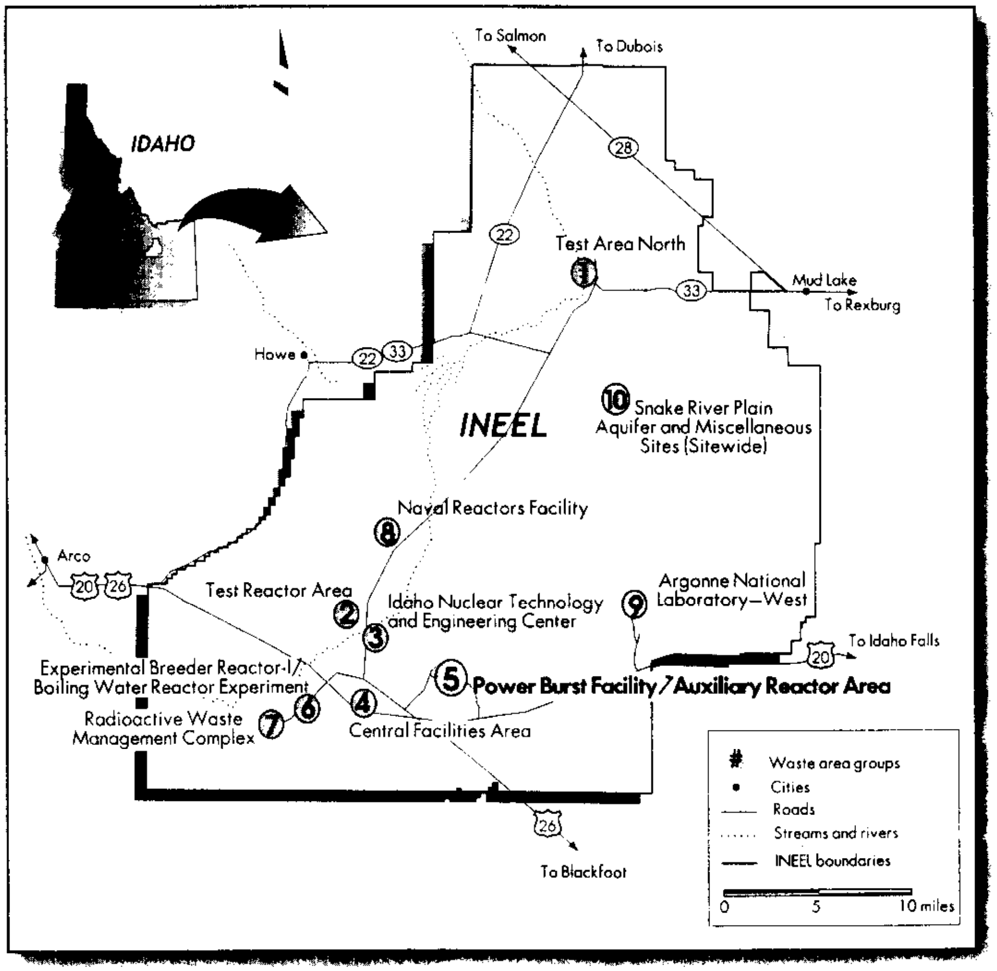


Figure 1. Cleanup activities at the Idaho National Engineering and Environmental Laboratory (INEEL) are divided among 10 Waste Area Groups.

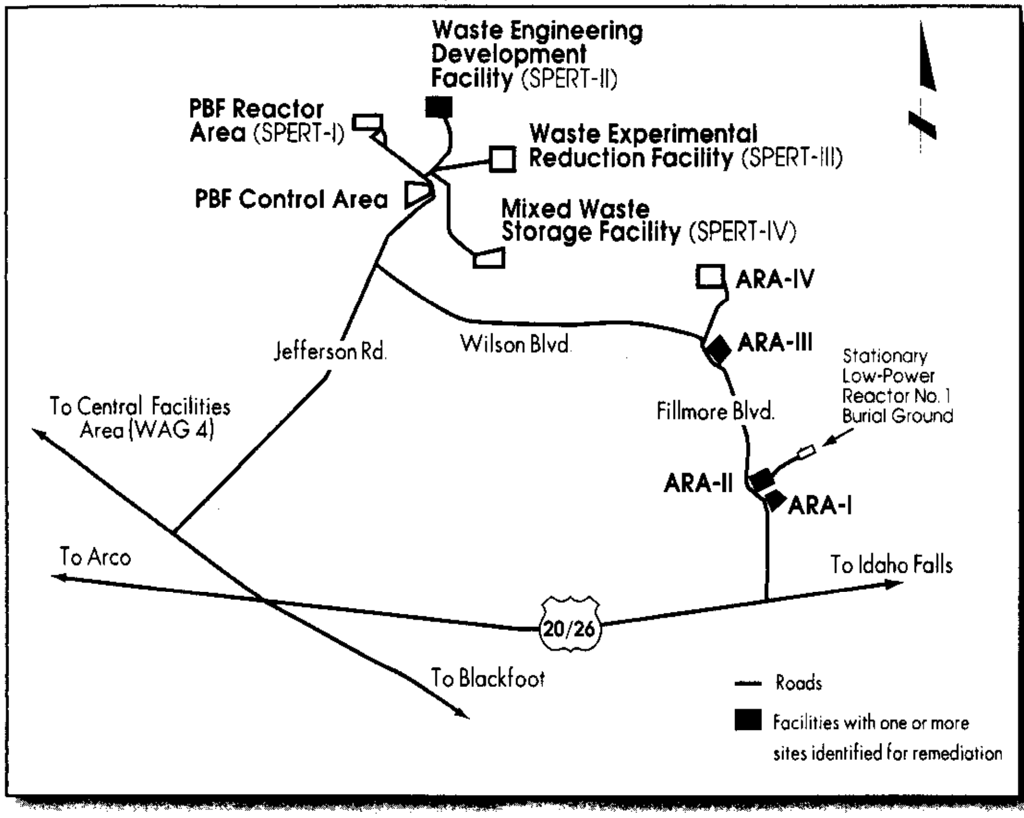


Figure 2. WAG 5 – the PBF and the ARA – includes nine operational areas spread across approximately 6,000 acres.

southeastern Idaho (Figure 1). Drainage within and around the plain recharges the Snake River Plain Aquifer. The aquifer provides groundwater for irrigation and drinking water throughout the Snake River Plain. The aquifer is about 200 feet below the surface at the north end of the INEEL and slopes downward to more than 900 feet below the surface at the south end. The ***vadose zone*** between the ground surface and the aquifer is about 455 feet thick below the PBF (with up to 23 feet of variation) and about 620 feet thick below the ARA.

The PBF was originally called the Special Power Excursion Reactor Test (SPERT) facility. It has five separate operational areas, as shown in Figure 2: the PBF Control Area, the PBF Reactor Area (SPERT-I), the Waste Engineering Development Facility (SPERT-II), the Waste Experimental Reduction Facility (SPERT-III), and the Mixed Waste Storage Facility (SPERT-IV). The area was constructed in the late 1950s for reactor safety experiments. The SPERT program was discontinued in 1970 and all reactors were removed. The PBF Reactor was constructed in 1972 and has not been operated since 1985. Current activities at the PBF focus on waste management and waste reduction.

The ARA was constructed in the late 1950s to support the Army Nuclear Program. It has four separate operational areas, as shown in Figure 2: ARA-I, ARA-II, ARA-III, and ARA-IV. The ARA-I, ARA-II, and ARA-III facilities have not been used since the late 1980s and are currently in varying stages of ***decontamination and dismantlement***. The ARA-IV facility was decontaminated and dismantled in 1985, and the ARA-IV area is now used for testing explosives.

Because of confirmed contaminant releases to the environment, the INEEL was placed on the ***National Priorities List*** of hazardous waste sites in 1989. The Agencies signed the ***Federal Facility Agreement and Consent Order*** in 1991 outlining the cleanup process and schedule for the INEEL.[7]

INFO The Snake River Plain Aquifer, one of the largest in the U.S., was classified as a sole-source aquifer by the EPA in 1991.[6] About 9% of the Snake River Plain Aquifer lies beneath the INEEL. The comprehensive investigation determined that contaminants at WAG 5 do not pose a risk to the aquifer.

vadose zone:

The unsaturated layers of geological materials extending from the ground surface down to the water table, or aquifer. The vadose zone can act as a filter or buffer that absorbs and slows movement of contaminants.

decontamination and dismantlement:

When facilities that contain radioactive or hazardous materials reach the end of their useful life, they are decommissioned (removed from operation). Depending on the amount and kinds of contamination, the facility can be decontaminated and used for another purpose or the facility can be decontaminated and torn down.

National Priorities List:

The EPA's formal list of the nation's hazardous waste sites that have been identified for possible remediation. The list ranks sites based on their potential risk to human health and the environment.

Federal Facility Agreement and Consent Order:

An agreement among the Agencies to evaluate potentially contaminated sites at the INEEL and perform remediation if necessary.

institutional controls:
Limited actions that minimize potential dangers to human health and the environment. The controls can include long-term environmental monitoring, access restrictions (such as fencing or other physical barriers, warning signs, and land-use restrictions), and maintenance (such as runoff control and repairs to fencing). These controls are required for a minimum of 100 years wherever low-level radioactive waste remains in place.[8] At WAG 5, the 100-year period of institutional control is assumed to run from 1998 to 2098.

heavy metals:
Metallic elements with high atomic weight that can damage living things at low concentrations and tend to accumulate in the food chain. Examples are mercury and lead.

radionuclides:
Forms of elements that give off radiation and can cause cancer. Examples are cesium-137 and radium-226. The radioactivity of these elements decreases by half over a period of time. This is referred to as a "half-life." Radionuclides can have half-lives ranging from a fraction of a second to billions of years.

baseline risk assessment:
The process of estimating the current and future impacts if no action were taken to remediate a site. Risk is assessed for two categories of receptor: human and ecological. Human health risk assessment evaluates the potential adverse health impacts to humans. Ecological risk assessment evaluates the potential adverse effects to populations of plants and animals.

Fifty-five potential release sites have been identified at WAG 5. This number includes 48 sites originally identified in the Federal Facility Agreement and Consent Order and seven more sites identified since 1991.

Thirty of the 55 WAG 5 sites are in the PBF. The evaluated sources of contamination at the PBF include past discharges to underground storage tanks, injection wells, septic systems, and several surface ponds.

Twenty-five of the 55 sites in WAG 5 are in the ARA. The evaluated sources of contamination at the ARA include past discharges to underground storage tanks, septic systems, and several surface ponds. In addition, there is a large windblown contamination area (the ARA-I and ARA-II Radiologically Contaminated Soils – ARA-23) associated with the cleanup of the 1961 Stationary Low-Power Reactor No. 1 (SL-1) accident.

Of the 55 sites in WAG 5, 48 require no remediation, though ***institutional controls*** will be maintained at sites with residual contamination. Seven sites are contaminated with non-metals, metals, ***heavy metals, radionuclides,*** or combinations of these contaminants. The risks from contaminants at the seven sites exceed thresholds for human health or the environment or both and are addressed by the alternatives reviewed in this proposed plan.

Summary of Risks

The ***baseline risk assessment*** of contaminated areas at WAG 5 is based on data summarized in the comprehensive investigation report.[9] The risk assessment examined three major areas:

- Contaminants of Concern: What contaminants are present that pose a risk to human health or the environment, and how toxic or carcinogenic are they?
- Exposure Pathways: How might humans, animals, or the environment come in contact with those contaminants?
- Receptors: What or who could be exposed to the contaminants?

Contaminants of Concern
at the Power Burst Facility/Auxiliary Reactor Area Sites

	Human Health	Ecological
Contaminated Soil Sites		
ARA-I Chemical Evaporation Pond (ARA-01)		Selenium Thallium
ARA-III Radioactive Waste Leach Pond (ARA-12)	Cesium-137 Silver-108m	Copper Mercury Selenium
ARA-I and ARA-II Radiologically Contaminated Soils (ARA-23)	Cesium-137	
ARA-I Soils Beneath the ARA-626 Hot Cells (ARA-25)	Arsenic Cesium-137 Radium-226	Copper Lead
SPERT-II Leach Pond (PBF-16)		Mercury
ARA-I Sanitary Waste System (ARA-02)	Cesium-137 Radium-226 Uranium-235 Uranium-238	
ARA-I Radionuclide Tank Site (ARA-16)	Cesium-137	

Potential carcinogenic (cancer-causing) and noncarcinogenic health effects to humans were quantified in the human health risk assessment.[10] The assessment was based on a hypothetical residential scenario that begins 100 years in the future. The assessment also included occupational scenarios to examine potential risks to current and future workers. The risk assessment evaluated exposure pathways, or how an individual would be exposed to a contaminant. Exposure pathways considered at WAG 5 included soil ingestion, dust inhalation, external radiation exposure, groundwater ingestion, homegrown produce ingestion, dermal (skin) absorption, and indoor water use.

Two indicators are used to evaluate the

significance of the human health risk assessment results: ***excess cancer risk*** and ***hazard index***. If the excess cancer risk is above the acceptable risk range of 10^{-4} to 10^{-6} (1 chance in 10,000 to 1 chance in 1,000,000) or if the hazard index for humans exceeds 1, site remediation is considered.

Potential adverse effects to plants and animals were evaluated in the ecological risk assessment.[11] The assessment included species common to WAG 5 and threatened or endangered species that may inhabit the area. One indicator, the ecological ***hazard quotient***, is used to evaluate the significance of the ecological risk assessment results. For WAG 5, alternatives for site remediation were evaluated if the ecological hazard quotient exceeds 10.

The decision to not remediate at a hazard quotient between 1 and 10 is based on the presumed conservative nature of the ecological risk assessment and the small size of sites relative to the entire INEEL. Though areas within individual WAG boundaries have been affected by human activities, most of the ecological environment at INEEL is undisturbed. Therefore, ecological receptor exposure to contamination is probably much less than predicted for most individual WAG sites. The site-wide ecological risk assessment to be conducted in the WAG 10 comprehensive investigation will be referenced during the 5-year review process for WAG 5 to determine if the decisions are still protective of the environment. Future remediation may be necessary if the WAG 10 site-wide assessment indicates that a cumulative ecological risk is exceeded for a population of receptors or if land use changes.

Results of the WAG 5 risk assessments showed that the risk thresholds were exceeded at seven sites. Human health thresholds were exceeded at five sites and ecological thresholds were exceeded at four sites. The primary exposure pathway of concern for human health is direct exposure to radiation. Dermal absorption of contamination is also a concern. Modeling of contaminant movement into groundwater (the groundwater ingestion pathway) indicates that contaminants at WAG 5 will not significantly impact groundwater quality. The human health and ecological risk assessment results are summarized in Table 1.

excess cancer risk:

The increased risk of cancer resulting from exposure to contaminants at a release site.

hazard index:

A ratio between the contaminant intake concentrations and the concentrations that are not likely to cause adverse effects. The human health hazard index is an indicator of potential adverse health effects other than cancer, especially to sensitive individuals such as pregnant women or children.

hazard quotient:

The ecological hazard quotient is an indicator of potential adverse effects to plant or animal populations.

INFO The risk assessment process provides information, not predictions. For example, the hypothetical future residential scenario models a person living in or next to a contaminated area. This scenario incorporates the assumption that no land use controls are implemented. For example, a future resident could unearth contamination through construction of a deep basement or raise a garden in contaminated soil. Current land use restrictions would prevent this residential scenario from occurring for at least the next 100 years.

INFO The acceptable risk range is a reflection of the cleanup levels that must be established to mitigate risk. The cleanup levels are influenced by such factors as site-specific conditions and potential future land use.

Table 1. Risk assessment results that exceed threshold values for Waste Area Group 5 sites identified for remediation.

	Human Health Risk						Ecological Risk
	Occupational Scenario				***Residential Scenario***		
	Current		*Future*		*Future*		
Site	Excess Cancer Risk	Hazard Index	Excess Cancer Risk	Hazard Index	Excess Cancer Risk	Hazard Index	Hazard Quotient > 10?
ARA-I Chemical Evaporation Pond (ARA-01)	-	-	-	-	-	-	Yes
ARA-III Radioactive Waste Leach Pond (ARA-12)	1 in 1,000	-	6 in 10,000	-	2 in 1,000	-	Yes
ARA-I and ARA-II Radiologically Contaminated Soils (ARA-23)	2 in 10,000	-	-	-	5 in 10,000	-	No
ARA-I Soils Beneath the ARA-626 Hot Cells (ARA-25)	5 in 1,000	-	2 in 1,000	-	7 in 1,000	2.0	Yes
SPERT-II Leach Pond (PBF-16)	-	-	-	-	-	-	Yes
ARA-I Sanitary Waste System Seepage Pit (ARA-02)	-	-	-	-	2 in 1,000	-	No
ARA-I Radionuclide Tank Site (ARA-16)	4 in 10,000	-	1 in 10,000	-	1 in 10,000	-	No

Note: A dash (--) indicates that the risk did not exceed threshold levels.

Evaluation Criteria and Cleanup Objectives

During the WAG 5 comprehensive investigation, cleanup alternatives were developed for the sites at which risk thresholds were exceeded. Development of alternatives was based on experience from previous feasibility studies conducted for other INEEL sites with similar characteristics. The alternatives must be evaluated against the nine criteria defined by **CERCLA**. These criteria encompass the legal requirements as well as other technical, economic, and practical factors. They are used to gauge the overall feasibility and acceptability of remedial alternatives.

The first two criteria – overall protection of human health and the environment and compliance with applicable or relevant and appropriate requirements (**ARARs**) – are considered "threshold criteria." An alternative must meet the threshold criteria to be considered for selection. The next five criteria are "balancing criteria" and are used to weigh major trade-offs among the alternatives. The final two criteria, called "modifying criteria," are used to evaluate acceptance of the alternatives by the state and the community.

The cleanup alternatives for the WAG 5 sites were evaluated based on the first seven CERCLA criteria. Results of the evaluation are presented in this proposed plan. Public comment is necessary to evaluate community acceptance of the preferred alternatives. Public input could result in the modification of cleanup alternatives. Agency concurrence is demonstrated by the signing of the Record of Decision.

To further guide the selection of cleanup alternatives, remedial action objectives are developed to define specific goals the cleanup action must achieve.[12] Remedial action objectives for ingestion of soil and groundwater were not developed because there were no unacceptable risks identified for these two exposure pathways. For the seven sites addressed in this proposed plan, the remedial action objectives are:

- Inhibit direct exposure to radionuclide contaminants of concern at any WAG 5 site or combination of sites that would result in a total excess cancer risk greater than or equal to 1 in 10,000 for current and future workers, and future residents.
- Inhibit ***dermal absorption*** of any WAG 5 contaminant of concern that would result in a hazard index of 2 or greater for current and future workers, and future residents.
- Prevent release of, and human and ecological exposures to, ARA-I Radionuclide Tank Site (ARA-16) tank contents.
- Inhibit ecological receptor exposures to contaminated soil with concentrations greater than or equal to 10 times background values and that result in a hazard quotient greater than or equal to 10. The remedial action objective excludes naturally occurring elements and compounds that are not attributable to WAG 5 releases.

The cleanup goals selected for WAG 5 are at the upper end of the acceptable risk range because conservative exposure parameters were used in the risk assessment for estimating risk due to nonradionuclides, and because EPA radiation standards, which apply to risks from exposure to radionuclides, are generally set at a risk level of 1 in 10,000.

Investigation-derived waste, including samples returned from analytical laboratories, was generated during the investigations of the WAG 5 sites. Actions taken during cleanup will include appropriate disposal of these wastes in compliance with regulations.

CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act):
The federal law that establishes a program to identify, evaluate, and remediate sites where hazardous substances may have been released (leaked, spilled, or dumped) to the environment. This act is also known as "Superfund."

ARAR:
Any state or federal statute that pertains to protection of human life or the environment in addressing specific conditions or use of a particular cleanup technology at a CERCLA site.

INFO The specific laws or regulations pertinent to cleanup actions at the seven sites are found in the following list:

- Idaho Hazardous Waste Management Act
- Resource Conservation and Recovery Act
- Rules for Control of Air Pollution in Idaho
- National Emission Standards for Hazardous Air Pollutants
- Native American Graves Protection and Repatriation Act
- National Archaeological and Historic Preservation Act
- Procedures for Planning and Implementing Off-Site Response Actions (40 CFR 300.440)

dermal absorption:
An exposure pathway describing a contaminant entering the body through the dermis (skin).

investigation-derived waste:
Contaminated soil, debris, liquids, sampling equipment, and personal protective equipment generated during site investigations.

The process of evaluating alternatives requires that the "No Action" Alternative be evaluated for each site to establish a baseline for comparison. Under the No Action Alternative, no cleanup action of any type would be performed. ***Environmental monitoring*** is the only activity that would continue.

environmental monitoring:

Sampling of soil, air, water, plants, or animals to detect changing conditions at a site that may require further evaluation. Environmental monitoring would continue for at least 100 years if contamination remains at the site.

Description of Sites and Evaluation of Alternatives

Remediation is proposed for seven sites in WAG 5. The comprehensive investigation report provides complete details about the investigation of each site. This proposed plan briefly summarizes the results of the investigation, identifies and evaluates the cleanup alternatives, and identifies the Agencies' preferred alternatives. A summary of the sites and the preferred alternative for each is included at the end of this plan along with the comment form.

Five of the seven sites consist of contaminated soil. These contaminated soil sites will be treated as a group. The remaining two sites are a sewage system and an underground tank that stored radioactive waste. These two sites also may include some contaminated soils. The first remedial action comparison presented in the proposed plan addresses all the contaminated soil identified for remediation in WAG 5. The second and third comparisons address only the contents and structures associated with a sewage system and an underground storage tank, respectively.

INFO CERCLA Evaluation Criteria

Threshold Criteria

✔ *Overall protection of human health and the environment*

Does the alternative protect human health and the environment by eliminating, reducing, or controlling the risk?

✔ *Compliance with applicable or relevant and appropriate requirements (ARARs)*

Does the alternative meet regulations?

Balancing Criteria

✔ *Long-term effectiveness and permanence*

Does the alternative reliably protect human health and the environment over time? Once cleanup goals have been met, will protection be maintained?

✔ *Reduction of toxicity, mobility, or volume through treatment*

Does the alternative use treatment to reduce the toxicity, mobility, or volume of the contaminants?

✔ *Short-term effectiveness*

Does the alternative pose any adverse impacts to human health or the environment during implementation?

✔ *Implementability*

How difficult is implementation of the alternative? Are the necessary materials and services available?

✔ *Cost*

What are the estimates for capital costs, and for operating and maintenance costs?

Modifying Criteria

✔ *State acceptance*

Does the state concur with the preferred alternative?

✔ *Community acceptance*

Does the public's general response support the preferred alternative?

INFO Cost for each alternative is calculated in terms of net present value. Net present value is a way to calculate cost estimates that factors in inflation but allows for equal comparison of long-term and short-term alternatives. Capital costs cover design and construction of cleanup facilities as well as management and oversight. Operating and maintenance costs cover treatment operations as well as facility decontamination and dismantlement, and long-term surveillance and monitoring.

Contaminated Soil Sites Summary

Sites

- ARA-I Chemical Evaporation Pond (ARA-01) (2,400 yd^3 of contaminated soil)
- ARA-III Radioactive Waste Leach Pond (ARA-12) (90 yd^3 of contaminated soil)
- ARA-I and ARA-II Radiologically Contaminated Soils (ARA-23) (46,500 yd^3 of contaminated soil)
- ARA-I Soils Beneath the ARA-626 Hot Cells (ARA-25) (70 yd^3 of contaminated soil)
- SPERT-II Leach Pond (PBF-16) (500 yd^3 of contaminated soil)

Contaminants of Concern

- Silver-108m
- Cesium-137
- Radium-226
- Arsenic
- Copper
- Lead
- Mercury
- Selenium
- Thallium

Alternatives Evaluated

1. No Action
2. Limited Action

3a. Excavation, Consolidation, and Containment with a Native Soil Cover within WAG 5

3b. Excavation, Consolidation, and Containment with an Engineered Barrier within WAG 5

4a. Removal and On-Site Disposal

4b. Removal and Off-Site Disposal

5a. Removal, Ex Situ Soil Sorting, and On-Site Disposal

5b. Removal, Ex Situ Soil Sorting, and Off-Site Disposal

Preferred Alternative

5a – Removal, Ex Situ Sorting, and On-Site Disposal

Advantages

- Easy to implement
- Cost effective
- Technologies, trained personnel, and specialized equipment are available

Disadvantages

- Does not reduce contaminant toxicity or volume
- Potential for worker exposure
- An on-site disposal facility has been proposed but is not currently available

Total Cost (in millions, net present value)

Capital	$ 19.6
Operating and Maintenance	NA
Total Cost ***(w/50% volume reduction)***	$ 19.6

NA = Not applicable. Operating and maintenance costs are not applicable because all contaminated media would be removed. Costs for institutional controls and monitoring are included in the fees for disposal at facilities outside of WAG 5.

Note: The contaminated soil sites and costs for remediation are discussed on pages 8 through 18 of this proposed plan.

Contaminated Soil Sites

The five contaminated soil sites are:

- ARA-I Chemical Evaporation Pond (ARA-01)
- ARA-III Radioactive Waste Leach Pond (ARA-12)
- ARA-I and ARA-II Radiologically Contaminated Soils (ARA-23)
- ARA-I Soils Beneath the ARA-626 Hot Cells (ARA-25)
- SPERT-II Leach Pond (PBF-16).

The comprehensive investigation report provides complete details about the investigation of each site.

ARA-I Chemical Evaporation Pond (ARA-01)

ARA-01 is an approximately 100- by 300-foot shallow, unlined pond (Figure 3). It was excavated in 1971 to receive laboratory wastewater from the ARA-I Shop and Maintenance Building. The pond, located southeast of the ARA-I facility, was used until 1988. The laboratory wastewater contained small quantities of radioactive substances and metals.

A remedial investigation/feasibility study was conducted to evaluate the risk associated with the pond and a Record of Decision was published in 1992. Based on samples collected from 1982 to 1990, no unacceptable risks to human or ecological receptors were identified. However, the evaluation of groundwater exposure pathways was deferred to another operable unit (the comprehensive investigation) because data were not sufficient to complete the study.

Additional sampling was conducted in 1997 to define the contamination at the site and evaluate groundwater risks. The results showed that contaminants were limited to the top 2 feet of soil. A complete risk assessment evaluating all exposure pathways was conducted in the comprehensive investigation. No unacceptable human health risks for any exposure pathway were identified, but analysis of the additional data showed a potential risk to ecological receptors from selenium and thallium. Table 2 describes the contaminants of concern for ARA-01. Because the site is so small and is adjacent to a much larger soil site that must be remediated (the ARA-I and ARA-II Radiologically Contaminated Soils – ARA-23), it is more cost efficient to clean up the site than to further evaluate the ecological risk.

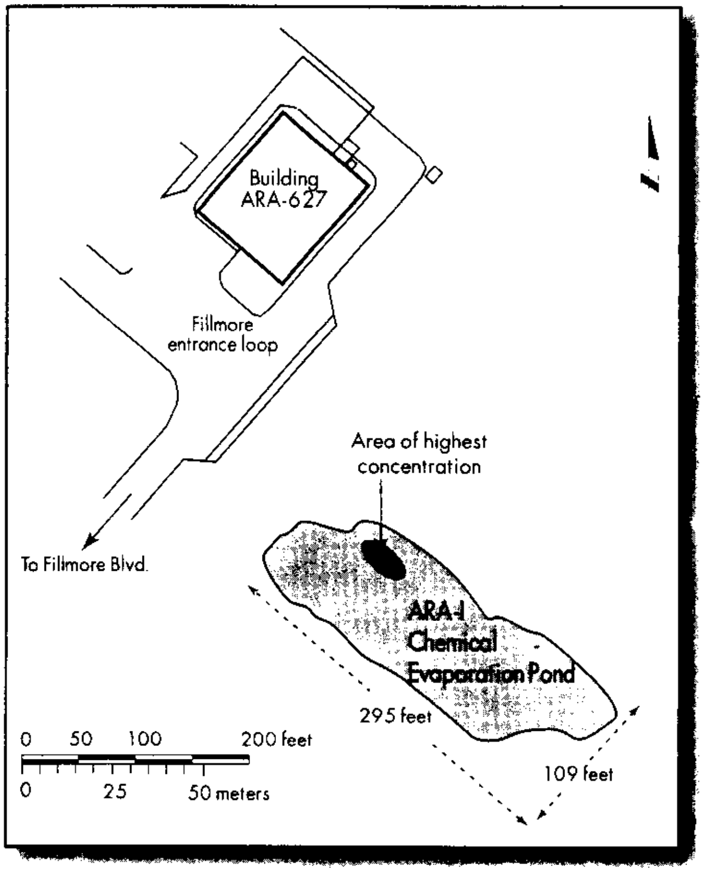


Figure 3. ARA-I Chemical Evaporation Pond (ARA-01).

Table 2. Ecological risk assessment contaminants of concern in 2,400 yd^3 of soil at ARA-I Chemical Evaporation Pond (ARA-01).

Contaminant of Concern	Maximum Detected Concentration (mg/kg)	Preliminary Remediation Goal (mg/kg)	Maximum Hazard Quotient
Selenium	27.2	2.2	300
Thallium	59.2	4.3	300

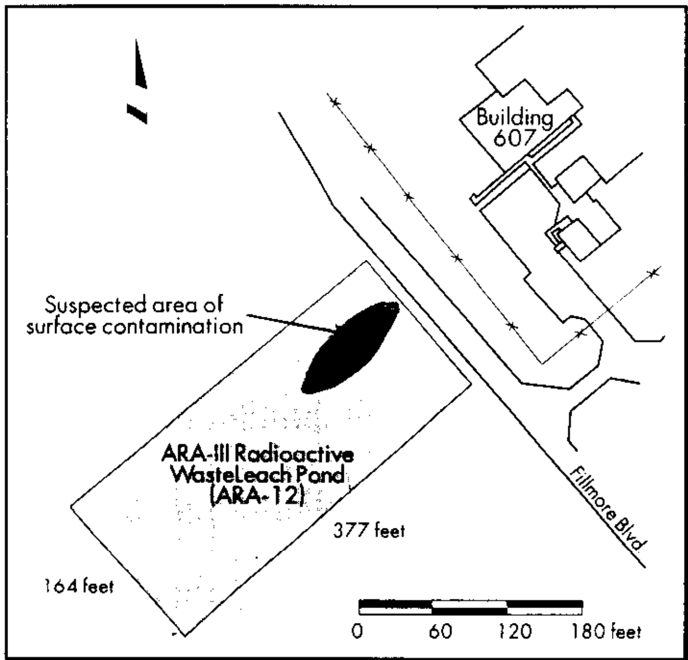


Figure 4. ARA-III Radioactive Waste Leach Pond (ARA-12).

ARA-III Radioactive Waste Leach Pond (ARA-12)

The ARA-12 site is an unlined surface pond approximately 150 feet by 400 feet (Figure 4). It was excavated in a natural depression west of the ARA-III facility about 1959 to receive liquid **low-level radioactive waste** from reactor research operations. Discharges to the pond also contained chromium. The tanks and waste lines to the leach pond were removed in 1993 during the decontamination and dismantlement of ARA-III.

Sampling was conducted in 1994 to define the contamination at the site. The results showed that contaminants were limited to the top 1 foot of soil at the site, and most are in an approximately 10 foot by 10 foot area close to the discharge pipe. Human health risks exceeded threshold levels for exposure to external radiation from cesium-137 and silver-108m. Copper, mercury, and selenium may exceed risk thresholds for ecological receptors. Because the site is so small and the area is identified for remediation based on human health risk estimates, it is less expensive to clean up the site than evaluate it further for ecological risk. Following additional radiological survey in 1997, a contaminated area just west of the pond boundary was identified. The ARA-12 boundary was expanded to include this area. Tables 3 and 4 describe the human health and ecological contaminants of concern for ARA-12.

low-level radioactive waste:
A term that refers to radioactive waste that does not fall into the categories high-level waste, transuranic waste, spent nuclear fuel, or by-product material. Most low-level waste includes relatively short-lived radionuclides. It may contain transuranic radionuclides in concentrations of less than 100 nanocuries per gram of waste, which is not high enough to warrant classification as transuranic waste. Some low-level waste may be safely disposed of using shallow land burial techniques.

Table 3. Human health risk assessment contaminants of concern in 90 yd^3 of soil at ARA-III Radioactive Waste Leach Pond (ARA-12).

Contaminant of Concern	Half-life (years)	Maximum Detected Concentration (pCi/g)	Preliminary Remediation Goal (pCi/g)	Future Residential Scenario Cancer Risk	Exposure Pathway
Cesium-137	30	380[a]	23	2 in 10,000	External exposure
Silver-108m	130	67.2	1.2	2 in 1,000	External exposure

a. The maximum concentration was detected by field survey techniques (global positioning radiometric scanner).

Table 4. Ecological risk assessment contaminants of concern in 90 yd^3 of soil at ARA-III Radioactive Waste Leach Pond (ARA-12).

Contaminant of Concern	Maximum Detected Concentration (mg/kg)	Preliminary Remediation Goal (mg/kg)	Maximum Hazard Quotient
Copper	623	220	300
Mercury	1.4	0.5	90
Selenium	2.7	2.2	30

ARA-I AND ARA-II Radiologically Contaminated Soils (ARA-23)

The ARA-23 site is a 58-acre area containing windblown contamination (Figure 5). It encompasses the ARA-I and ARA-II facilities and the area surrounding the Stationary Low-Power Reactor 1 (SL-1) Burial Ground. Most of the contamination came from cleanup of the accidental destruction of the SL-1 reactor in 1961.

The boundaries of ARA-23 encompass four other contamination sites (ARA-01, ARA-02, ARA-16, and ARA-25) that will be remediated separately. Any contaminated subsurface foundations, water lines, and pipes remaining from previously dismantled facilities that are encountered during remediation activities will be remediated or decontaminated and left in place.

INFO The Stationary Low-Power Reactor No. 1 (SL-1) Burial Ground is an area east of ARA-II where contaminated soil and debris were buried after the 1961 SL-1 accident. An engineered cover was placed over the burial ground in 1996.

Sampling was conducted between 1961 and 1997 to define the contamination at the site. The results showed that contaminants were limited to the top 4 inches of soil. Cesium-137 exceeds risk thresholds under both the occupational and residential scenarios. Table 5 describes the human health contaminant of concern for ARA-23.

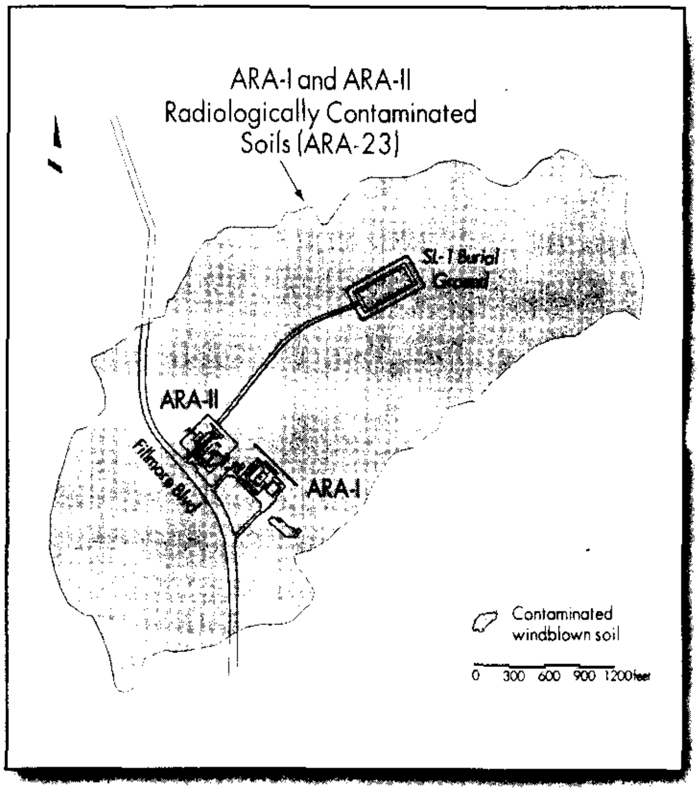


Figure 5. ARA-I and ARA-II Radiologically Contaminated Soils (ARA-23).

Table 5. Human health risk assessment contaminant of concern in 46,500 yd^3 of soil at ARA-I and ARA-II Radiologically Contaminated Soils (ARA-23).

Contaminant of Concern	Half-life (years)	Maximum Detected Concentration (pCi/g)	Preliminary Remediation Goal (pCi/g)	Future Residential Scenario Cancer Risk	Exposure Pathway
Cesium-137	30	2,530[a]	23	5 in 10,000	External exposure

a. The maximum concentration was detected by field survey techniques (global positioning radiometric scanner).

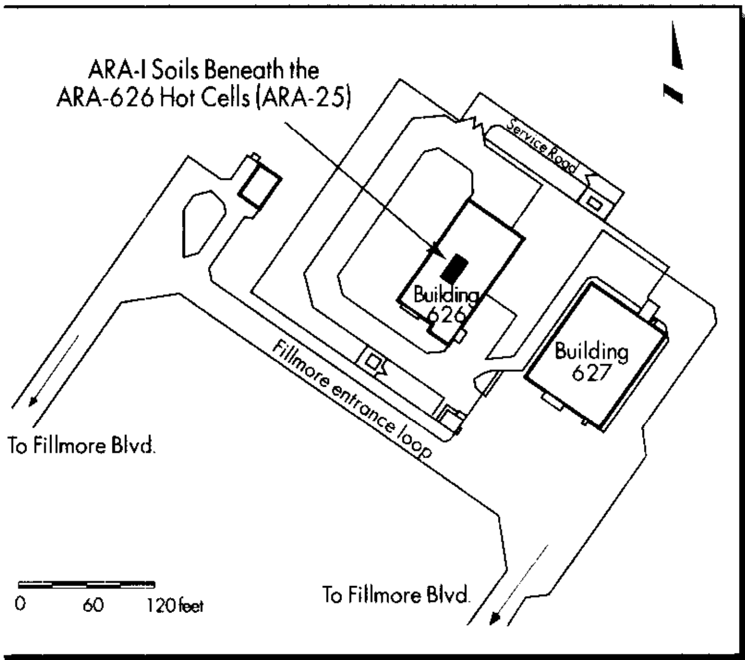


Figure 6. ARA-I Soils Beneath the ARA-626 Hot Cells (ARA-25).

ARA-I Soils Beneath the ARA-626 Hot Cells (ARA-25)

The ARA-25 site was discovered in 1998 during decontamination and dismantlement of the ARA-626 Hot Cells (Figure 6). When floor slabs of the ARA-626 building were removed, contamination was discovered in the soil below, especially around several floor drains. The drains were connected by stainless steel piping to the ARA-I Radionuclide Tank Site (ARA-16) (see page 24). The contaminated soil has a maximum depth of 5 feet and covers an approximately 384 square foot area.

The results of the risk assessment show that arsenic, radium-226, cesium-137 are present at levels posing risks to human health. Copper and lead are the two contaminants that may pose risks to ecological receptors. Because the site is so small and the area is identified for remediation based on human health risk estimates, it is less expensive to clean up the site than evaluate it further for ecological risk. Tables 6 and 7 describe the human health and ecological contaminants of concern for ARA-25.

Table 6. Human health risk assessment contaminants of concern in 70 yd^3 of soil at ARA-I Soils Beneath the ARA-626 Hot Cells (ARA-25).

Contaminant of Concern	Half-life (years)	Maximum Detected Concentration[a]	Preliminary Remediation Goal[a]	Future Residential Scenario Cancer Risk	Exposure Pathway
Arsenic	NA	40.6 mg/kg	10 mg/kg	3 in 10,000[b]	Dermal absorption
Cesium-137	30	449 pCi/g	23 pCi/g	2 in 1,000	External exposure
Radium-226	1,600	29.7 pCi/g	2.2 pCi/g	5 in 1,000	External exposure

a. Radionuclides such as cesium-137 and radium-226 are measured in pCi/g. Other materials such as metals are measured in mg/kg.
b. Arsenic also has noncarcinogenic properties that may result in toxic effects. At this site, arsenic has a hazard index of 2 primarily from potential dermal absorption.

Table 7. Ecological risk assessment contaminants of concern in 70 yd^3 of soil at ARA-I Soils Beneath the ARA-626 Hot Cells (ARA-25).

Contaminant of Concern	Maximum Detected Concentration (mg/kg)	Preliminary Remediation Goal (mg/kg)	Maximum Hazard Quotient
Copper	227	220	40
Lead	1,430	400[a]	900

a. The lead preliminary remediation goal is the EPA-approved screening level.

SPERT-II Leach Pond (PBF-16)

The PBF-16 site is a fenced, unlined shallow pond south of the Waste Engineering Development Facility (Figure 7). The pond was used from 1959 to 1964 to dispose of spent sulfuric acid and sodium hydroxide solutions, water softener waste, emergency shower drain water, and discharges from the SPERT-II reactor building floor drains. Currently, the only discharge to the pond is clean water from the PBF maintenance shop air compressor.

Sampling was conducted in 1982 and 1983 to define the contamination at the site. The results showed that contaminants were limited to a depth of 4.5 feet. No contaminants are present at levels that pose risks to human health. However, mercury is present at concentrations that may pose risks to ecological receptors. Because the site is so small, it is less expensive to clean up the site than to further evaluate the ecological risk. Table 8 describes the ecological contaminant of concern for PBF-16.

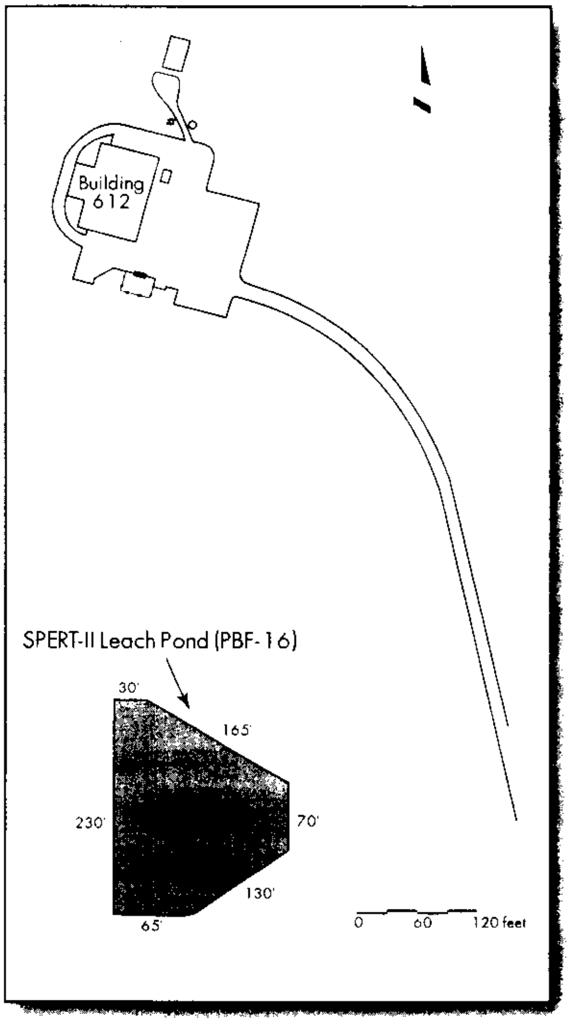


Figure 7. SPERT-II Leach Pond (PBF-16).

Table 8. Ecological risk assessment contaminants of concern in 500 yd^3 of soil at SPERT-II Leach Pond (PBF-16).

Contaminant of Concern	Maximum Detected Concentration (mg/kg)	Preliminary Remediation Goal (mg/kg)	Maximum Hazard Quotient
Mercury	0.71	0.5	50

ARARs

INFO The principal ARAR evaluated for the contaminated soil sites was the Idaho Fugitive Dust Emissions regulation. For the Preferred Alternative 5a, this ARAR will be satisfied through standard dust control techniques.

Evaluation of Alternatives

Five alternatives were considered for the contaminated soil sites. Three alternatives (1, 2, and 3a) do not meet the threshold criteria for protection of human health and the environment and compliance with regulations. However, Alternative 1, the No Action Alternative, was evaluated in detail to provide a point of comparison for other alternatives.

Alternatives 2 (Limited Action) and 3a (Soil Excavation, Consolidation, and Containment with a Native Soil Cover within WAG 5) were eliminated during preliminary evaluation. Alternative 2 would protect human health and the environment only during the 100-year period of institutional control. After that, it would not satisfy the threshold requirements for protection of human health and the environment and compliance with regulations. Alternative 3a, a 10-foot-thick soil barrier, also would not be protective of human health and the environment. A soil barrier would not provide adequate protection for ecological intrusion and long-term protection for long-lived radionuclides because it could erode. Alternatives 2 and 3a are not discussed further in this plan. The comprehensive investigation report provides complete explanations of these conclusions.[13]

The remaining alternatives (3b, 4, and 5) were retained for detailed evaluation. Alternatives 4 and 5 are very similar, differing only in the added step of ex situ soil sorting that would be implemented if proven to be cost effective. These two alternatives were combined into Alternative 5, which includes soil sorting using a soil separation technology, for presentation in this proposed plan. The variations 5a and 5b represent on-site and off-site disposal options. Table 9 on page 18 summarizes the detailed evaluation of Alternatives 1, 3b, 5a, and 5b. The comprehensive investigation report provides complete details about all alternatives.[14]

Alternative 1 - No Action

Description. Under the No Action Alternative, no cleanup action of any type would be performed. The only activity would be environmental monitoring.

Evaluation. The No Action Alternative would not meet the threshold criteria for protection of human health and the environment and compliance with regulations. Long-term effectiveness would be low. There would not be a reduction in toxicity, mobility, or volume through treatment. Short-term effectiveness would be high because no handling or transport of contaminants would be required. Implementability would be high because the recommended management practice (annual environmental monitoring inspections and 5-year reviews) is already in place. The estimated $8.2 million cost would mainly result from long-term monitoring.

INFO Alternative 2 (Limited Action) was eliminated during preliminary evaluation.

INFO Alternative 3a (Soil Excavation, Consolidation, and Containment with a Native Soil Cover within WAG 5) was eliminated during preliminary evaluation.

Alternative 3b - Soil Excavation, Consolidation, and Containment with an Engineered Barrier within WAG 5

Description. Alternative 3b involves removing the contaminated soils from the individual sites, consolidating the soils above ground at one location within WAG 5, and constructing a cap for containment. Excavations at the individual sites would be contoured to match surrounding terrain and revegetated. Excavations deeper than 1 foot would be backfilled with clean soil before contouring. At the consolidation site, institutional controls would be implemented. Environmental monitoring and monitoring of the cap would be conducted annually. Cracks, erosion, biotic intrusion, and other degradation of the cap would be repaired. Air and groundwater monitoring would be performed under INEEL site-wide programs. Site reviews would be carried out every 5 years to evaluate the effectiveness of the barrier and the need for additional environmental monitoring and maintenance requirements.

The Alternative 3b cap would be an engineered barrier such as the cover constructed in 1996 at the SL-1 Burial Ground. The SL-1 cap consists of a 12-inch thick layer of small basalt rocks (cobbles) sandwiched between 8-inch thick layers of gravel and capped with a 2-foot thick layer of basalt boulders (riprap). The riprap surface layer retards erosion, which could result in exposure and migration of contaminants. Both the riprap and the cobble layers discourage intrusion by humans, plants, insects, and animals. Surface radiation exposures would be reduced to background levels by the shielding effects of the layers of material. The barrier is designed to require little or no maintenance.

Evaluation. Alternative 3b would meet the threshold criteria for protection of human health and the environment and compliance with regulations. Long-term effectiveness would be moderate because, although the contamination would be contained, the barrier would require monitoring and maintenance. Because some of the contaminants have long half-lives, maintaining institutional controls would be necessary well beyond 100 years. This alternative would not reduce toxicity, mobility, or volume through treatment. The short-term effectiveness would be moderate because equipment operators and site personnel could be exposed during excavation, consolidation, and cap construction activities. Implementability would be moderate because the alternative involves excavation, transport, consolidation, and cap construction; and institutional controls beyond 100 years would be required. Construction personnel and materials are readily available on the INEEL. The estimated $17.9 million cost would include excavation, transportation, consolidation, and cap construction, as well as maintenance and monitoring.

INFO Alternative 4a (Removal and On-Site Disposal) was combined with Alternative 5a in this proposed plan.

INFO Alternative 4b (Removal and Off-Site Disposal) was combined with Alternative 5b in this proposed plan.

Alternative 5a - Removal, Ex Situ Soil Sorting, and On-Site Disposal

Preferred Alternative

Alternative 5b - Removal, Ex Situ Soil Sorting, and Off-Site Disposal

Description. Under Alternative 5, the contaminated soil would be removed using conventional construction equipment, soil vacuuming equipment, or a combination of both. The contaminated soil would be selectively removed or sorted to minimize the volume of soil requiring disposal. Either mechanical separation, or advanced, real-time field screening will be used. A treatability study planned for mid-1999 will be conducted to demonstrate the volume reduction that may be achieved using Thermo NUtech's proprietary Segmented Gate System. If the results of the treatability study show that the Segmented Gate System could significantly reduce costs, advanced real-time field screening will be applied. The system uses an arrangement of conveyor belts, radiation detectors, and segmented gates to detect and separate radioactive soil from clean soil in the field. The system works by conveying the contaminated soil under two arrays of sensitive gamma-radiation detectors. Material contaminated above a specified threshold is diverted by segmented gates and stockpiled for disposal. The Segmented Gate System could significantly reduce the overall amount of material requiring disposal and the costs associated with disposal. The feasibility study evaluated an assumed 50% volume

ex situ:
No longer in its original location. Ex situ treatments are technologies that remove the contaminated material, through conventional or remote excavation methods, before treatment.

INFO Thermo NUtech is a subsidiary of Thermo Remediation, a Thermo Electron Company. Thermo NUtech has provided its Segmented Gate System services to DOE at numerous contaminated soil sites.

reduction. However, it is anticipated that the Segmented Gate System may achieve volume reduction as high as 90%. If sorting does not substantially reduce disposal costs, ex situ soil sorting techniques will not be implemented.

on-site:
Use of an approved facility at the INEEL for treatment or disposal (for example, the proposed INEEL CERCLA Disposal Facility).

off-site:
Use of an approved facility off the INEEL (for example, the Envirocare facility in Clive, Utah).

INFO The proposed INEEL CERCLA Disposal Facility (ICDF) was selected for evaluation in the comprehensive investigation. The facility, which would cover about 54 acres south of the Idaho Nuclear Technology and Engineering Center (formerly the ICPP), would accept only wastes generated within INEEL boundaries during CERCLA actions. The ICDF will be an engineered facility meeting RCRA Subtitle C design and construction requirements. The facility is currently under review by stakeholders. If developed, it would open for receipt of soils in the year 2003. If the ICDF or other on-site facility such as the Radioactive Waste Management Complex is not available, an off-site disposal facility will be used.

Contaminated soil would be packaged and transported either to an ***on-site*** facility such as the INEEL CERCLA Disposal Facility (Alternative 5a) or to an ***off-site*** facility such as Envirocare (Alternative 5b) for final disposal. Clean soil would be returned to the excavation site, and soil samples would be collected and sent for laboratory analysis to confirm that remedial goals are met. Excavations at the individual sites would be contoured to match surrounding terrain and revegetated. Excavations deeper than 1 foot would be backfilled with additional clean soil before contouring.

Evaluation. Both Alternative 5 variations would meet the threshold requirements for protection of human health and the environment, and compliance with regulations. Long-term effectiveness would be high because contaminated soil would be removed from the sites and no monitoring or maintenance would be required at the end of 100 years of institutional control.

Both Alternative 5 variations would not reduce toxicity or mobility through treatment, but sorting, if implemented, would reduce the overall volume of soil requiring disposal. The short-term effectiveness would be moderate for both variations because equipment operators and site personnel could be exposed during excavation, sorting, packaging, transportation, and disposal activities. The additional short-term risks associated with transportation and disposal of soil to an off-site facility are readily controlled and are not sufficient to reduce the comparative ranking for Alternative 5b.

Implementability would be moderate for Alternative 5a and high for Alternative 5b. The implementability for Alternative 5a is lower because an on-site disposal location may not be available. Otherwise, implementability is comparable for the two variations. Proposed excavation and soil separation equipment (including modifications necessary to protect operators) is currently available. Characterization, packaging, transportation, and disposal of contaminated materials all would use currently available technologies, and trained personnel and specialized equipment would be available.

Cost estimates for Alternatives 5a and 5b were developed to reflect varying degrees of volume reduction through sorting. For Alternative 5a, the estimates are $13.8 million for no sorting (no volume reduction), $19.6 million for sorting that achieves 50% volume reduction, and $14.9 million for sorting that achieves 90% volume reduction. For Alternative 5b, the cost estimate for no sorting is $28.8 million, and is $27.2 million if 50% volume reduction is achieved. A cost estimate for Alternative 5b based on 90% volume reduction was not developed.

Preferred Alternative Summary

Preferred Alternative for the Contaminated Soil Sites

The preferred alternative for the contaminated soil sites (ARA-01, ARA-12, ARA-23, ARA-25, and PBF-16) is Alternative 5a – Removal, Ex Situ Soil Sorting, and On-Site Disposal. Alternative 5a is preferred over Alternative 5b because of the additional costs associated with transport and disposal of contaminated soil off-site. Otherwise, the evaluations of the two variations differ only slightly. If the INEEL CERCLA Disposal Facility or some other acceptable on-site location is not available when the contaminated soils are remediated, then Alternative 5b is preferred as a contingency. The decision process for selecting on-site or off-site disposal is illustrated in Figure 8.

Alternative 5a satisfies the threshold criteria for protection of human health and the environment, and compliance with regulations. Long-term effectiveness would be high because contaminants would be removed from individual sites. Toxicity and mobility would not be reduced through treatment, though volume would be reduced if soil sorting is implemented. Short-term effectiveness would be moderate because of the possibility for worker exposure during excavation, sorting, packaging, transportation, and disposal activities. This alternative would be moderately easy to implement. Though all necessary technologies and personnel are available, an on-site disposal facility is not currently available.

Alternative 3b – Soil Excavation, Consolidation, and Containment and Alternative 5b – Removal, Ex Situ Sorting, and Off-Site Disposal also satisfy the threshold criteria. Compared to Alternative 3b, Alternative 5a would have greater long-term effectiveness and approximately the same implementability. Implementability for Alternative 5a is approximately the same as for Alternative 3b because institutional controls beyond 100 years would be required for contamination remaining at WAG 5. Compared to Alternative 5b, Alternative 5a is less implementable because an on-site disposal location may not be available. The risk associated with characterizing and packaging waste for transportation in Alternatives 5a and 5b are nearly the same. For Alternative 3b, additional short-term risk from consolidation and cap construction is balanced against the Alternative 5b characterization, packaging, and transportation risk. The short-term effectiveness of Alternatives 3b, 5a, and 5b is approximately equal.

Assuming no volume reduction through soil sorting, Alternative 3b would cost approximately $17.9 million compared to $13.8 million for Alternative 5a. Alternatives 5a and 5b have the same long-term effectiveness. Short-term effectiveness would be slightly less for Alternative 5b because of the potential risks associated with off-site shipment. Implementability for Alternative 5b would be slightly higher because an off-site disposal location is available. Alternative 5b would cost more because of the additional expenses for transportation and off-site disposal.

INFO The range of cost estimates for Alternative 5a is based on a cleanup goal of 23 pCi/g of cesium-137, a level that will leave contaminated areas safe for residential use 100 years from now. More restrictive future land uses could result in possible cost reductions because less restrictive cleanup levels could be imposed. For example, the cesium-137 cleanup goal would be 110 pCi/g instead of 23 pCi/g at ARA-23 if land use were restricted to industrial applications beginning in 100 years. Because the industrial scenario is not used to identify cleanup objectives and remedial alternatives, a thorough evaluation has not been developed. Gross approximations indicate that about half as much unsorted soil from ARA-23 would require remediation for a future industrial scenario at a cost ranging from $8.3 to $12.4 million. Compared to the estimated cost of $13.8 million for unsorted soil disposed of on-site (Alternative 5a) for the future residential scenario, cleaning up to future industrial use criteria could save between $1.4 and $5.5 million.

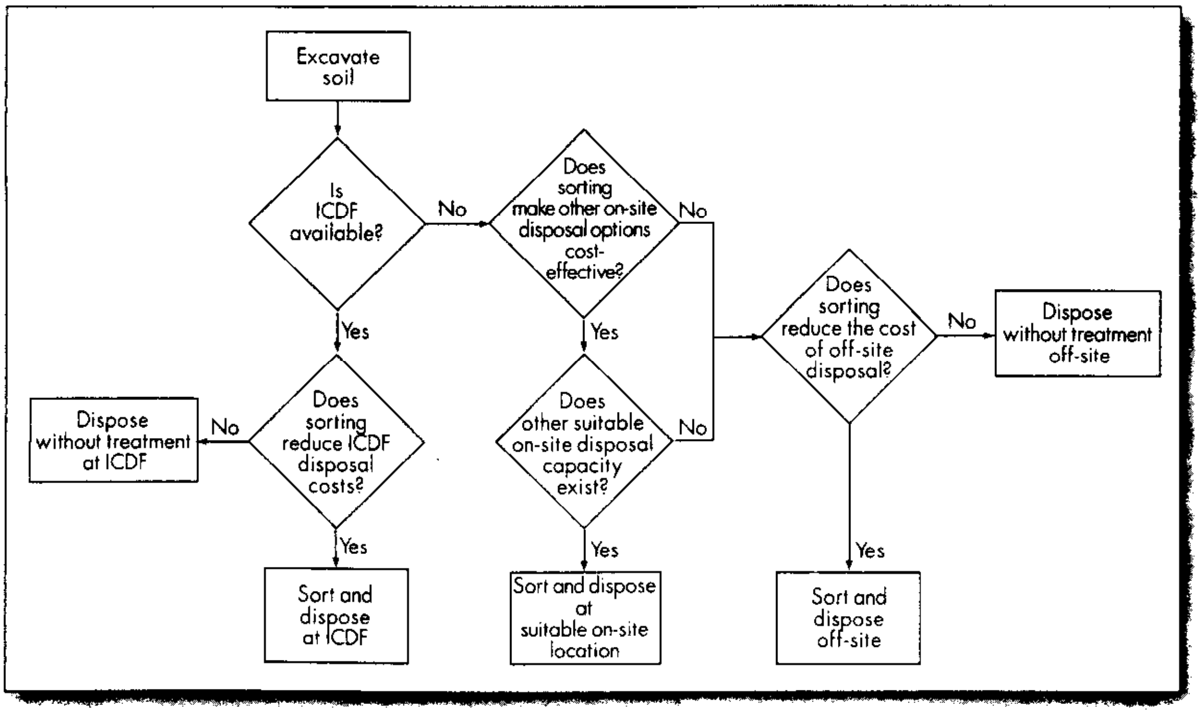


Figure 8. Decision process to determine disposal location and whether soil sorting will be implemented.

Table 9. Comparison of alternatives for the contaminated soil sites.

	Alternatives						
	No Action **1**	Soil Excavation, Consolidation, and Containment **3b**	Removal, Ex Situ Soil Sorting, and Disposal: On-Site **5a**			Removal, Ex Situ Soil Sorting, and Disposal: Off-Site **5b**	
Criterion				✓			
Threshold Criteria [a]							
Overall protection	N	Y		Y		Y	
Compliance with the laws	N	Y		Y		Y	
Balancing Criteria							
Long-term effectiveness	○	◒		●		●	
Reduction of toxicity, mobility, or volume through treatment	○	○		◒		◒	
Short-term effectiveness	●	◒		◒		◒	
Implementability	●	◒		◒		●	
Cost (millions) [b,c,d]							
Volume reduction			0%	50%	90%	0%	50%
Capital costs	$ 1.0	$ 9.7	$ 13.8	$ 19.6	$ 14.9	$28.8	$ 27.2
Operating and maintenance costs	7.2	8.2	-	-	-	-	-
Total Cost	$ 8.2	$ 17.9	$ 13.8	$ 19.6	$ 14.9	$28.8	$ 27.2

a. An alternative must meet the threshold criteria to be considered for selection. Each alternative either fully satisfies the criteria or does not. Alternative 1, the No Action Alternative, was evaluated in detail to provide a point of comparison for other alternatives. Alternatives 2 and 3a did not meet the threshold criteria and were eliminated from detailed analysis. Alternatives 4 and 5 were combined for discussion in this proposed plan.

b. Costs are presented in net present value.

c. The estimates for Alternatives 3b, 5a, and 5b include costs for remediating contaminated soil from the Radionuclide Tank Site (ARA-16).

d. Detailed cost estimates are provided in Appendix K of the comprehensive investigation report. Because contaminated media would remain within Waste Area Group 5 for Alternatives 1 and 3b, operating and maintenance costs include 5-year review, institutional controls, and monitoring. Similar costs for Alternatives 5a and 5b are included in the fees for disposal at facilities outside of Waste Area Group 5.

✓ Indicates the preferred alternative

Y Yes, meets criterion

N No, does not meet criterion

● High, best satisfies criterion

◒ Moderate, partially satisfies criterion

○ Low, least satisfies criterion

Sanitary Waste System Summary

Site

- ARA-I Sanitary Waste System (ARA-02)
(2 yd^3 of contaminated sludge and
structural components of the sanitary waste system)

Contaminants of Concern[a]

- Cesium-137
- Radium-226
- Uranium-235
- Uranium-238

Alternatives Evaluated

1. No Action
2. Limited Action
3a. Removal, Ex Situ Thermal Treatment, and Disposal
3b. Removal, Ex Situ Chemical Stabilization, and Disposal
4. In Situ Stabilization and Encapsulation

a. The contaminants of concern are in the residual sludge in the seepage pit.

b. Estimated costs address the treatment of the residual sludge and debris including the cinder blocks and pipes. If contaminated soil is identified during remediation, the soil will be included in the remediation of soil site ARA-23.

Preferred Alternative

3a – Removal, Ex Situ Thermal Treatment, and Disposal

Advantages

- Easy to implement
- Cost effective
- Reduces contaminant toxicity, mobility, and volume
- Technologies, trained personnel, and specialized equipment are available
- Removes all contaminated media

Disadvantages

- Potential for worker exposure

Total Cost (in millions, net present value)[b]

Capital	$2.0
Operating and Maintenance	NA
Total	$2.0

NA = Not Applicable. Operating and maintenance costs are not applicable because all contaminated media would be removed. Costs for institutional controls and monitoring are included in the fees for disposal at facilities outside of WAG 5.

Sanitary Waste System Site (ARA-02)

ARA-02 is a sewage system south of ARA-I that includes a series of three septic tanks, a seepage pit, and piping connecting the septic tanks into the pit (Figure 9). The system was built in 1960 to service ARA-I buildings. The concrete septic tanks drain into a 400-foot-long pipeline that leads to the seepage pit. The 9-foot-diameter pit was excavated into the underlying basalt to 10 feet. The pit walls were lined with cinder blocks, the floor was lined with gravel, and a concrete lid was placed on top. Approximately 6 inches of dried residual sludge remain in the bottom of the pit.

The sanitary waste system was used until 1988 when ARA-I was shut down. Although no process wastes were known to have been routed to the system, ***low-level mixed waste*** was detected in the septic tanks and seepage pit.

The contents of the septic tanks were removed in 1996 in a separate activity and have been maintained in compliant storage pending treatment and disposal at the Oak Ridge National Laboratory. Recently the State of Tennessee issued a moratorium on accepting out-of-state waste. The moratorium may become a final decision. Arrangements are being made to send the 47 drums of waste that satisfy the waste acceptance criteria to the Waste Experimental Reduction Facility for incineration. The remaining 8 drums of waste contain PCBs in concentrations that

low-level mixed waste: Waste that is both hazardous and contains low-level radioactive materials. Hazardous waste possesses one or more of four characteristics (ignitability, corrosivity, reactivity, or toxicity).

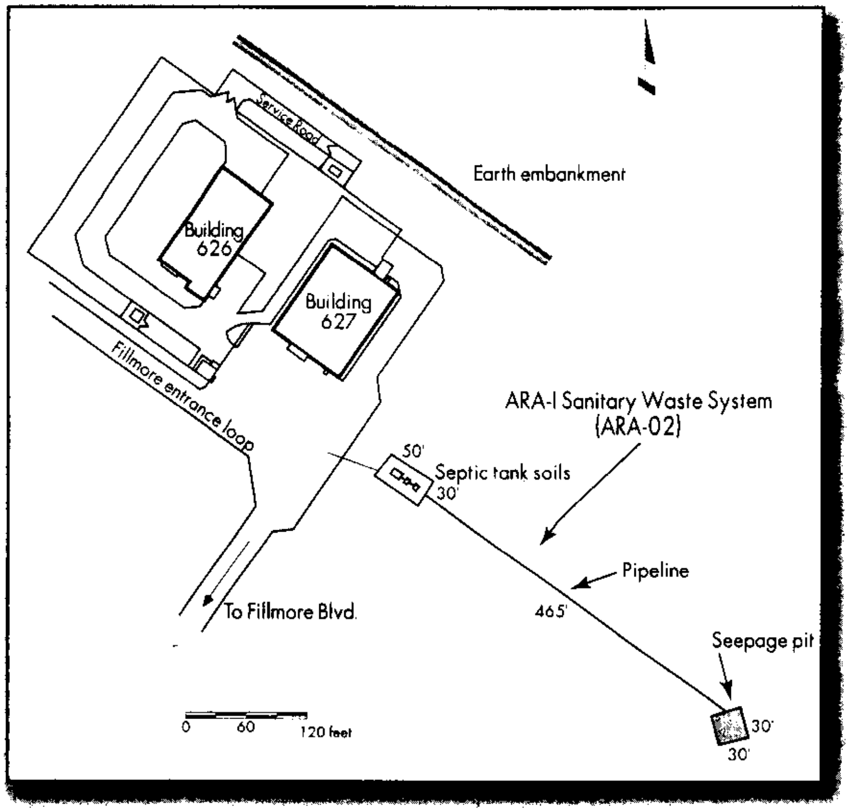


Figure 9. ARA-I Sanitary Waste System (ARA-02).

exceed the waste acceptance criteria. This waste will be maintained in compliant storage at ARA until it can be sent to the Advanced Mixed Waste Treatment Facility or other licensed, compliant, commercial facility for treatment and disposal. If the waste is not shipped within 2 years of the WAG 5 record of decision, it will be relocated to the Mixed Waste Storage Facility or other compliant centralized INEEL location for continued storage until a treatment facility is available. The empty septic tanks, the piping, and the seepage pit and its contents were left in place.

Sampling was conducted in 1992 and 1997 to define the contamination at the site. Risk thresholds were not exceeded in soils around the septic tanks. The residual sludge at the bottom of the seepage pit and the soils immediately surrounding the pit were evaluated. Contaminants were detected in relatively high concentrations in the sludge. Radium-226, cesium-137, uranium-235, and uranium-238 exceeded acceptable risk thresholds for human health. Table 10 describes the contaminants of concern for ARA-02.

The comprehensive investigation report provides complete details about the investigation of this site.

ARARs

INFO The principal ARARs evaluated for the Sanitary Waste System Site were the Hazardous Waste Management Act and the RCRA treatment requirements. For the preferred Alternative 3a, these ARARs will be satisfied by treating and disposing of the seepage pit sludge at a RCRA-permitted facility.

INFO Alternative 2 (Limited Action) was eliminated during preliminary evaluation.

Evaluation of Alternatives

Four alternatives were considered for the sanitary waste system site. Alternative 1 does not meet the threshold criteria for protection of human health and the environment and compliance with regulations. However, the No Action Alternative was evaluated in detail to provide a point of comparison for other alternatives.

Alternative 2 (Limited Action) was eliminated during preliminary evaluation. Alternative 2 would protect human health and the environment only during the 100-year period of institutional control. After that, it would not satisfy the threshold requirements for protection of human health and the environment and compliance with regulations.

The remaining alternatives (3a and 4) are described and evaluated below. Table 11 on page 23 summarizes the evaluation of alternatives. The comprehensive investigation report provides complete details about all alternatives.[15]

Alternative 1 - No Action

Description. Under the No Action Alternative, no cleanup action of any type would be performed. The only activity would be environmental monitoring.

Evaluation. The No Action Alternative would not meet the threshold criteria for protection of human health and the environment and compliance with regulations. Long-term effectiveness would be low. This alternative would not reduce toxicity, mobility, or volume through treatment. Short-term effectiveness would be high because no handling or transport of contaminants would be required. Implementability would be high because the recommended management practice (annual environmental monitoring inspections and 5-year reviews) is already in place. The estimated $9.4 million cost would mainly result from long-term monitoring.

Alternative 3a - Removal, Ex Situ Thermal Treatment, and Disposal

Preferred Alternative

Description. Alternative 3 consists of removing the residual sludge and gravel from the bottom of the seepage pit, and the cinder blocks lining the walls of the pit; excavating the surrounding soil, the septic tanks, and the piping; treating the excavated materials; and restoring the site. Two variations of this alternative were developed, differing in the treatment of the sludge: ex situ thermal treatment (Alternative 3a) and ex situ chemical stabilization (Alternative 3b). However, because chemical stabilization is not readily implementable and is much more expensive than thermal treatment, a detailed evaluation of Alternative 3b was not completed. Therefore, variation 3b is not discussed further in this plan. The comprehensive investigation report provides complete explanations of this conclusion.[16]

Under Alternative 3a, the seepage pit sludge would be packaged and shipped to the INEEL Waste Experimental Reduction Facility for incineration (thermal treatment) because the sludge would meet waste acceptance criteria. Treatment residuals (ash) would be transported to an off-site facility for final disposal. The cinder blocks would be transported to an off-site facility for final disposal. The septic tanks and piping would be decontaminated and disposed of at an on-site facility. The excavations would be backfilled with clean soil, contoured to match the surrounding terrain, and revegetated.

INFO Alternative 3b (Removal, Ex Situ Chemical Stabilization, and Disposal) was eliminated during preliminary evaluation.

Evaluation. Alternative 3 would protect human health and the environment and would comply with regulations. Long-term effectiveness would be high because all contaminated materials would be removed. Treatment would reduce toxicity, mobility, and volume of contaminants. Short-term effectiveness would be moderate because site personnel could be exposed during excavation, transportation, treatment, and disposal activities. Implementability of this alternative would be

Table 10. Human health risk assessment contaminants of concern in 2 yd^3 of dried sludge at ARA-I Sanitary Waste System Seepage Pit (ARA-02).[a]

Contaminant of Concern	Half-life (years)	Maximum Detected Concentration (pCi/g)	Preliminary Remediation Goal (pCi/g)	Future Residential Scenario Cancer Risk	Exposure Pathway
Cesium-137	30	178	23	7 in 100,000[b]	External exposure
Radium-226	1,600	89.6	2.2	2 in 1,000	External exposure
Uranium-235	704 million	120	13	9 in 100,000[b]	External exposure
Uranium-238	4.46 billion	112	67	3 in 100,000[b]	External exposure

a. Potential noncarcinogenic effects from polychlorinated biphenyls will be eliminated by remediating the sludge to address radioactivity.

b. Cesium-137, uranium-235, and uranium-238 are identified as contaminants of concern for ARA-02 because their combined risk exceeds the threshold value.

high since required equipment and services are currently available. The estimated cost of $2.0 million includes excavation, transportation, treatment, and payment of a one-time disposal facility fee.

Alternative 4 - In Situ Stabilization and Encapsulation

Description. Alternative 4, In Situ Stabilization and Encapsulation, would consist of partially filling the seepage pit with soil, grouting the seepage pit sludge and cinder blocks in place, then filling the remainder of the pit with grout material to stabilize the waste and completely encapsulate the entire seepage pit. In addition, the three empty concrete septic tanks and associated piping would be filled with grout. Institutional controls and environmental monitoring would be implemented to restrict access and confirm that contamination was not migrating from the site.

Evaluation. Alternative 4 would protect human health and the environment and would comply with regulations. Long-term effectiveness would be moderate because, although the contamination would be contained, monitoring and maintenance would be required. This alternative would not reduce toxicity through treatment, and the volume would be increased. However, contaminant mobility would be reduced by more than 90%. The short-term effectiveness would be moderate because equipment operators and site personnel could be exposed during remediation activities. Implementability would be high because the alternative would use available technology and personnel. The estimated $7.5 million cost is the higher cost of the two alternatives that meet threshold criteria.

Preferred Alternative Summary

Preferred Alternative for the Sanitary Waste System Site

The preferred alternative to remediate the Sanitary Waste System Site (ARA-02) is Alternative 3a – Removal, Ex Situ Thermal Treatment, and Disposal. This alternative would protect human health and the environment and comply with regulations. Long-term effectiveness would be high because all contaminated materials would be removed. Toxicity, mobility, and volume would be reduced through treatment. Short-term effectiveness would be moderate because of the possibility for worker exposure during excavation, transportation, treatment, and disposal activities. This alternative would be easy to implement because the services and personnel required are available. The cost is the lowest of the alternatives considered.

Compared to the other alternative that meets the threshold criteria (Alternative 4), Alternative 3a would have greater long-term effectiveness; greater reduction of toxicity, mobility, or volume; about the same short-term effectiveness; the same ranking for implementability; and much lower cost.

Table 11. Comparison of alternatives for the sanitary waste system site.

	Alternatives		
	No Action **1**	Removal, Ex Situ Thermal Treatment, and On-Site Disposal **3a**	In Situ Stabilization and Encapsulation **4**
Criterion		☑	
Threshold Criteria [a]			
Overall protection	Ⓝ	Ⓨ	Ⓨ
Compliance with the laws	Ⓝ	Ⓨ	Ⓨ
Balancing Criteria			
Long-term effectiveness	○	●	◒
Reduction of toxicity, mobility, or volume through treatment	○	●	◒
Short-term effectiveness	●	◒	◒
Implementability	●	●	●
Cost (millions) [b,c,d]			
Capital costs	$ 1.6	$ 2.0	$ 1.9
Operating and maintenance costs	7.8	-	5.6
Total Cost	$ 9.4	$ 2.0	$ 7.5

a. An alternative must meet the threshold criteria to be considered for selection. Each alternative either fully satisfies the criteria or does not. Alternative 1, the No Action Alternative, was evaluated in detail to provide a point of comparison for other alternatives. Alternative 2 did not meet the threshold criteria and was eliminated from detailed analysis.

b. Costs are presented in net present value.

c. Estimated costs for Alternative 4a address treatment of the residual sludge in the seepage pit and debris (including the cinder blocks and pipes). If contaminated soil is identified during remediation, the soil will be included in the remediation of soil site ARA-23.

d. Detailed cost estimates are provided in Appendix K of the comprehensive investigation report. Because contaminated media would remain within Waste Area Group 5 for Alternatives 1 and 4, operating and maintenance costs include 5-year review, institutional controls, and monitoring. Similar costs for Alternative 3a are included in the fees for disposal at facilities outside of Waste Area Group 5.

☑ Indicates the preferred alternative

Ⓨ Yes, meets criterion

Ⓝ No, does not meet criterion

● High, best satisfies criterion

◒ Moderate, partially satisfies criterion

○ Low, least satisfies criterion

Radionuclide Tank Site Summary

Site

- ARA-I Radionuclide Tank (ARA-16) (65 yd^3 of contaminated soil)

Contaminant of Concern[a]
- Cesium-137

Alternatives Evaluated

1. No Action
2. Limited Action

3a. In Situ Vitrification of the ARA-16 Tank at the Existing Tank Site

3b1. Removal and In Situ Vitrification of the ARA-16 Tank at Test Area North

3b2. Removal and In Situ Vitrification of the ARA-16 Tank Waste at Test Area North

4a. Removal, Ex Situ Thermal Treatment, and On-Site Disposal

4b. Removal, Ex Situ Thermal Treatment, and Off-Site Disposal

5a. Removal, Ex Situ Stabilization, and On-Site Disposal

5b. Removal, Ex Situ Stabilization, and Off-Site Disposal

a. Risk from the tank contents was not evaluated because no release has occurred. The tank contains PCB-contaminated mixed waste. Risk estimates are based only on cesium-137 detected in the soil.

b. The Advanced Mixed Waste Treatment Facility at the INEEL will begin operating in 2003.

c. Estimated costs address the treatment of the tank contents and debris. Costs for remediating the ARA-16 contaminated soils and gravel are included in the contaminated soil sites alternatives.

Preferred Alternative

4a – Removal, Ex Situ Thermal Treatment, and On-Site Disposal

Advantages

- Easy to implement
- Cost effective
- Reduces contaminant toxicity, mobility, and volume

Disadvantages

- Potential for worker exposure
- No treatment or disposal facility is currently available[b]

Total Cost (in millions, net present value)[c]

Capital	$4.4
Operating and Maintenance	NA
Total	$4.4

NA = Not Applicable. Operating and maintenance costs are not applicable because all contaminated media would be removed. Costs for institutional controls and monitoring are included in the fees for disposal at facilities outside of WAG 5.

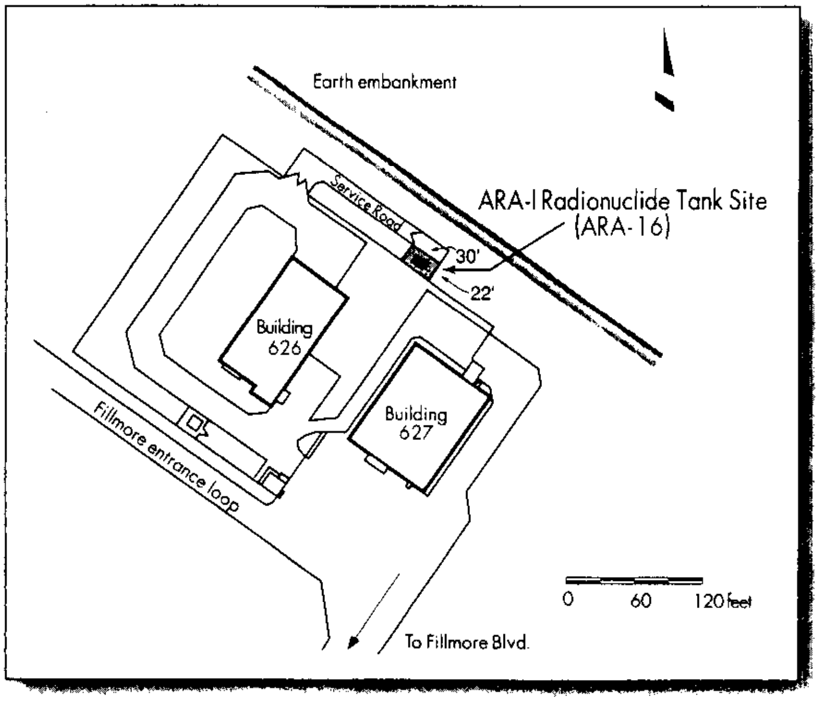


Figure 10. ARA-I Radionuclide Tank Site (ARA-16).

Radionuclide Tank Site (ARA-16)

The ARA-16 radionuclide tank site includes a 1,000-gallon underground storage tank, the waste within it, the concrete vault cradling it, and the soil and gravel surrounding the vault and overlying the tank (Figure 10).

The stainless steel storage tank rests within a lidless concrete vault and is covered by approximately 3.5 feet of soil. From 1959 to 1988, the tank was used for temporary storage of radioactive liquid waste from the ARA-I hot cells, and materials testing, and research, and metal-etching processes. Through sampling results and anecdotal information, the tank contents were identified as ***mixed waste.***

When ARA-I was shut down in 1988, the tank was partially excavated, all lines in and out of the tank were cut and capped, the contents of the tank were pumped out, and the excavated soils were replaced over the tank. Approximately 29 gallons of liquid and sludge remain in the tank.

mixed waste:

Waste that contains both radionuclides and hazardous waste.

Sampling was conducted in 1988 and 1997 to define the contamination at the site. The entire area is affected by the windblown contamination from the cleanup of the SL-I Reactor accident (see ARA-I and ARA-II Radiologically Contaminated Soils site – ARA-23 on page 11). Cesium-137 in the soil and gravel in and around the tank vault were determined to exceed risk thresholds. Although no releases have occurred from the tank and the tank is not leaking, the tank contents could pose a risk should a release occur. Therefore, cleanup alternatives include the tank contents and structure as well as the contaminated soil. Table 12 describes the contaminant of concern for ARA-16 and Table 13 lists the constituents detected in the tank contents.

The comprehensive investigation report provides complete details about the investigation of this site.

Table 12. Human health risk assessment contaminant of concern in 65 yd^3 of soil at ARA-I Radionuclide Tank Site (ARA-16).

Contaminant of Concern	Half-life (years)	Maximum Detected Concentration (pCi/g)	Preliminary Remediation Goal (pCi/g)	Future Residential Scenario Cancer Risk	Exposure Pathway
Cesium-137	30	201	23	1 in 10,000	External exposure

Table 13. Constituents in the ARA-I Radionuclide Tank Site (ARA-16) tank contents.

RCRA Code	Listed Constituents	Other Constituents				
F001	1,1,1-trichloroethane	Actinium-227	Cobalt-60	Nickel-63	Protactinium-234	Thorium-234
F001	Trichloroethylene	Americium-241	Curium-244	Plutonium-238	Protactinium-234m	Tritium (hydrogen-3)
F002	Tetrachloroethylene	Barium-137m	Europium-152	Plutonium-239	Promethium-147	Uranium-234
F003	Xylenes	Carbon-14	Europium-154	Plutonium-240	Silver-110	Uranium-238
F005	Toluene	Cesium-134	Iron-55	Plutonium-241	Strontium-90	Yttrium-90
		Cesium-137	Nickel-59	Protactinium-231	Thorium-231	Zinc-65

Evaluation of Alternatives

Five alternatives were considered for the radionuclide tank site. Two alternatives (1 and 2) do not meet the threshold criteria for protection of human health and the environment and compliance with regulations. However, Alternative 1 (No Action), was evaluated in detail to provide a point of comparison for other alternatives.

Alternative 2 (Limited Action) was eliminated during preliminary evaluation. Alternative 2 would protect human health and the environment only during the 100-year period of institutional control. After that, it would not satisfy the threshold requirements for protection of human health and the environment and compliance with regulations. Therefore, this alternative is not discussed further in this plan.

ARARs

INFO The principal ARARs evaluated for the Radionuclide Tank Site were the Hazardous Waste Management Act closure requirements, the RCRA treatment and delisting requirements, disposal criteria for polychlorinated biphenyls, and off-site disposal requirements for Off-Site Response Actions. For the Preferred Alternative 4, these ARARs will be satisfied by treating and disposing of the tank waste at a RCRA- and TSCA-permitted facility.

Alternative 5 (Removal, Ex Situ Stabilization, and Disposal) was eliminated during evaluation. Alternative 5 would protect human health and the environment because all waste, contaminated soil, and debris would be removed from the site. Stabilization would require extensive treatability testing and be costly because of the high level of radioactive and toxic contaminants. The resulting waste could not currently be accepted at any existing operating disposal facility. The comprehensive investigation report provides complete explanations of these conclusions.[17]

The remaining alternatives (3 and 4) are described and evaluated below. Table 14 on page 29 summarizes the evaluation of these alternatives. The comprehensive investigation report provides complete details about all alternatives.[18]

Alternative 1 - No Action

Description. Under the No Action Alternative, no cleanup action of any type would be performed. The only activity would be environmental monitoring.

Evaluation. The No Action Alternative would not meet the threshold criteria for protection of human health and the environment and compliance with regulations. Long-term effectiveness would be low. This alternative would not reduce toxicity, mobility, or volume through treatment. Short-term effectiveness would be high because no handling or transport of contaminants would be required. Implementability would be high because the recommended management practice (annual environmental monitoring inspections and 5-year reviews) is already in place. The estimated $9.4 million cost would mainly result from long-term monitoring.

INFO Alternative 2 (Limited Action) was eliminated during evaluation.

Alternative 3 - In Situ Vitrification

Alternative 3 consists of ***in situ vitrification***. Alternative 3 has three variations: 3a, 3b1, and 3b2. Under Alternative 3a, the entire site, including the tank, the tank contents, and contaminated soil, would be vitrified in situ. Under Alternative 3b1, the intact tank and its contents would be excavated and shipped to Test Area North where it would be reburied and treated by vitrification. Under Alternative 3b2, the contents of the tank would be removed, shipped to Test Area North, and placed into one of the V-Tanks for in situ vitrification.[19]

in situ vitrification:
The in-place melting of material through the use of electrical current. The process turns the contaminated materials into a glass-like solid.

Alternative 3a - In Situ Vitrification of the ARA-16 Tank at the Existing Tank Site

Description. Alternative 3a would consist of in situ vitrification of the entire ARA-16 tank site, including the tank and its contents, the vault, the piping, and the surrounding soil and gravel. In situ vitrification would destroy the toxic organic compounds in the tank waste and immobilize the radionuclides and toxic metals in a glass-like solid. The treated area would be backfilled, compacted, and capped with a soil cover. Environmental monitoring would be conducted following the remedial action because contamination would remain at the site. Site reviews would be conducted every 5 years to evaluate the effectiveness of the institutional controls and assess the need for further environmental monitoring or additional control measures.

INFO In situ means literally "in place." Typically, in situ treatments remediate the contamination in place without excavation. However, for greater efficiency, contaminants may be removed from their original location, reburied in another location, and treated there. This is still considered an in situ treatment.

Evaluation. Alternative 3a would meet the threshold criteria for protection of human health and the environment and compliance with regulations. Long-term effectiveness would be moderate, because the waste would remain at the site. Reduction of toxicity, mobility, and volume of contaminants would be moderate. Mobility would be greatly reduced, the volume would be reduced by half, and the toxicity of the organic contaminants would be eliminated. However, the toxicity of the inorganic and radioactive contaminants would not be reduced. Short-term effectiveness would be moderate, because of the potential risks to workers during vitrification activities. Implementability of this alternative would be moderate, because in situ vitrification has not been demonstrated on buried tanks containing PCB-contaminated mixed waste. The estimated cost of $8.5 million would be higher than for the other variations of

Alternative 3 primarily because of long-term monitoring and maintenance requirements associated with leaving contaminated media at the site.

Alternative 3b1 - Removal and In Situ Vitrification of the ARA-16 Tank at Test Area North

Description. Alternative 3b1 consists of excavating the tank system and surrounding contaminated soils, transporting the tank with its contents to Test Area North, and burying the tank for in situ vitrification with the Test Area North V-Tanks. The associated piping system and concrete vault would be decontaminated and disposed of as low-level waste. The contaminated soil would be cleaned up under the alternative selected for the contaminated soil sites.

Evaluation. Alternative 3b1 would meet the threshold criterion for protection of human health and the environment. It is expected that compliance with regulations would be achieved, but post-remedial verification would be required. Long-term effectiveness would be high, because the waste would the removed from the site. Reduction of toxicity, mobility, and volume of contaminants would be reduced by half, and the toxicity of the organic contaminants would be eliminated. However, the toxicity of the inorganic and radioactive contaminants would not be reduced. Short-term effectiveness of this alternative would be moderate because site personnel could be exposed during excavation, transportation, and treatment activities. Implementability of this alternative would be low because in situ vitrification has not yet been approved for remediation of the V-Tanks at Test Area North (WAG 1), has not been demonstrated on buried tanks containing ***polychlorinated biphenyl*** (PCB)-contaminated mixed waste, and compliance with ARARs would have to be demonstrated. The estimated cost of $3.8 million would be the lowest of the Alternative 3 variations.

polychlorinated biphenyls (PCBs):
A family of industrial compounds that can be toxic or carcinogenic (cancer-causing).

Alternative 3b2 - Removal and In Situ Vitrification of the ARA-16 Tank Waste at Test Area North

Description. Under Alternative 3b2, the contents would be removed from the ARA-16 tank, put in containers, transported to Test Area North, and placed in a Test Area North V-Tank for subsequent in situ vitrification. The empty ARA-16 tank, associated piping, and vault would be excavated and decontaminated prior to on-site disposal. The contaminated soil would be cleaned up under the alternative selected for the contaminated soil sites.

Evaluation. Alternative 3b2 would meet the threshold criterion for protection of human health and the environment. It is expected that compliance with regulations would be achieved, but post-remedial verification would be required. Long-term effectiveness would be high, because the waste would be removed from the site. Reduction of toxicity, mobility, and volume of contaminants would be moderate. Mobility would be greatly reduced, the volume would be reduced by half, and the toxicity of the organic contaminants would be eliminated. However, the toxicity of the inorganic and radioactive contaminants would not be reduced. Short-term effectiveness of this alternative would be moderate because site personnel could be exposed during excavation, transportation, and treatment activities. Implementability of this alternative would be low because in situ vitrification has not yet been approved for remediation of the V-tanks at Test Area North (WAG 1), has not been demonstrated on buried tanks containing PCB-contaminated mixed waste, and compliance with ARARs would have to be demonstrated. The estimated cost of $4.6 million would be slightly higher than the cost for Alternative 3b1.

Alternative 4 - Removal, Ex Situ Thermal Treatment, and Disposal

☑ Preferred Alternative

Description. Alternative 4 consists of excavating the ARA-16 tank, removing and storing the waste, treating the waste, excavating the surrounding soils, and restoring the site.

To satisfy regulations, the tank contents must be treated before disposal. However, an approved treatment facility does not currently exist. Therefore, the tank contents would be packaged and stored at the INEEL Radioactive Waste Management Complex until the Advanced Mixed Waste Treatment Facility (AMWTF) is operational. The time frame for the planned opening of the AMWTF coincides fairly well with the planned remediation of the ARA-16. There are several reasons for removing the contents of ARA-16 for interim storage instead of leaving it in place until the AMWTF opens. First, the tank is within the ARA-23 contaminated soil site area and could interfere with cleanup. Second, though there are some hazards associated with interim storage, such hazards are easily minimized by standard procedures and responsible management. Third, the risk of a release to the environment increases with time. Cleanup of any future release would be more complicated and costly than the issues posed by interim storage. Finally, the waste will be managed in compliant storage should the opening of the AMWTF be delayed.

INFO The Advanced Mixed Waste Treatment Facility (AMWTF) will treat waste to meet acceptance criteria for the Waste Isolation Pilot Plant near Carlsbad, New Mexico. The privatized facility will be located at the Radioactive Waste Management Complex and will begin operating by early 2003.

The ARA-16 tank and associated piping would be decontaminated to the extent possible and disposed of on-site as low-level waste. The vault would also be disposed of on-site. Decontamination residues would be treated at the INEEL Waste Experimental Reduction Facility and the residual waste (ash) would be disposed of off-site. The contaminated soil would be cleaned up under the alternative selected for the contaminated soil sites. The excavations would be backfilled with clean soil, contoured to match the surrounding terrain, and revegetated.

Evaluation. Alternative 4 would meet the threshold criteria for protection of human health and the environment and compliance with regulations. Long-term effectiveness would be high, because the waste would be removed from the site. Reduction of toxicity, mobility, and volume through treatment would be moderate. Thermal treatment would destroy the organic contaminants and reduce the volume of waste by more than half. The toxicity of the radionuclides and toxic metals would not be reduced, although the mobility of these contaminants would be greatly reduced. Short-term effectiveness of this alternative would be moderate because site personnel could be exposed during excavation, transportation, and treatment activities. Implementability would be moderate because of uncertainties surrounding the Advanced Mixed Waste Treatment Facility. The estimated cost of $4.4 million includes excavation, transportation, treatment, and disposal fees.

INFO Alternative 5 (Removal, Ex Situ Stabilization, and Disposal) was eliminated during evaluation.

Preferred Alternative Summary ☑

Preferred Alternative for the Radionuclide Tank Site

The preferred alternative to remediate the Radionuclide Tank Site (ARA-16) is Alternative 4 – Removal, Ex Situ Thermal Treatment, and Disposal. This alternative would protect human health and the environment and comply with regulations. Long-term effectiveness would be high because all contaminated material would be removed. Toxicity, mobility, and volume would be reduced through treatment. Short-term effectiveness would be moderate because of the possibility for worker exposure during excavation, transportation, treatment, and disposal. Implementability would be moderate because the Advanced Mixed Waste Treatment Facility has not yet been constructed.

Compared to the other alternatives that meet the threshold criteria (3a, 3b1, and 3b2), Alternative 4 would have the same or greater long-term effectiveness; the same reduction of toxicity and mobility, or a slightly greater reduction of volume through treatment; and the same short-term effectiveness. The implementability of Alternatives 3a and 4 would both be moderate compared to low for Alternatives 3b1 and 3b2. The estimated cost for Alternative 4 is about the same as for Alternatives 3b1 and 3b2 and much lower than for Alternative 3a.

Table 14. Comparison of alternatives for the ARA-I Radionuclide Tank Site (ARA-16).

	Alternatives				
			Removal and In Situ Vitrification		
	No Action 1	In Situ Vitrification 3a	of Entire Tank at TAN 3b1	of Tank Waste at TAN 3b2	Removal, Ex Situ Thermal Treatment, and Disposal 4
Criterion					☑
Threshold Criteria[a]					
Overall protection	Ⓝ	Ⓨ	Ⓨ	Ⓨ	Ⓨ
Compliance with the laws	Ⓝ	Ⓨ	Ⓨ	Ⓨ	Ⓨ
Balancing Criteria					
Long-term effectiveness	○	◒	●	●	●
Reduction of toxicity, mobility, or volume through treatment	○	◒	◒	◒	◒
Short-term effectiveness	●	◒	◒	◒	◒
Implementability	●	◒	○	○	◒
Cost (millions) [b,c,d]					
Capital costs	$ 1.6	$ 3.6	$ 3.8	$ 4.6	$ 4.4
Operating and maintenance costs	7.8	4.9	-	-	-
Total Cost	$ 9.4	$ 8.5	$ 3.8	$ 4.6	$ 4.4

a. An alternative must meet the threshold criteria to be considered for selection. Each alternative either fully satisfies the criteria or does not. Alternative 1, the No Action Alternative, was evaluated in detail to provide a point of comparison for other alternatives. Alternative 2 did not meet the threshold criteria and was eliminated from detailed analysis. It is expected that compliance with the laws would be achieved by Alternatives 3b1 and 3b2, but post-remedial verification would be required.

b. Costs are presented in net present value.

c. For Alternatives 3b1, 3b2, and 4, costs for remediating ARA-16 contaminated soils are included in the contaminated soil alternatives in Table 9.

d. Detailed cost estimates are provided in Appendix K of the comprehensive investigation report. Because contaminated media would remain within Waste Area Group 5 for Alternatives 1 and 3a, operating and maintenance costs include 5-year review, institutional controls, and monitoring. Similar costs for Alternatives 3b1, 3b2, and 4 are included in the fees for disposal at facilities outside of Waste Area Group 5.

☑ Indicates the preferred alternative

Ⓨ Yes, meets criterion

Ⓝ No, does not meet criterion

● High, best satisfies criterion

◒ Moderate, partially satisfies criterion

○ Low, least satisfies criterion

Sites Not Requiring Cleanup

The Agencies propose that no remediation will be conducted under CERCLA for 48 of the 55 sites in WAG 5. The comprehensive investigation showed that there is no source of contamination associated with the 19 sites listed in Table 15. The 29 sites listed in Table 16 have contamination left in place that does not present an unacceptable risk to human health or the environment. The status of the sites in Table 16 will be reviewed during the 5-year review process to ensure that site conditions have not changed significantly and the status of each site remains consistent with the record of decision. Established institutional controls for these sites will be maintained until unrestricted release is approved during a 5-year review.

More detail is contained in the WAG 5 update fact sheet dated January 1999.[20] Additional information for each site is provided in the comprehensive investigation report.[21]

Table 15. Sites not requiring institutional controls or 5-year reviews.

ARA-04:	ARA-I Sewage Treatment Facility (ARA-737)
ARA-05:	ARA-I Evaporation Pond to the Northeast (ARA-744)
ARA-09:	ARA-II Septic Tank (ARA-738)
ARA-10:	ARA-II Septic Tank East (ARA-613)
ARA-11:	ARA-II Septic Tank West (ARA-606)
ARA-14:	ARA-III Septic Tank and Drain Field (ARA-739)
ARA-15:	ARA-III Radionuclide Tank (ARA-735)
ARA-17:	ARA-I Drain (ARA-626)
ARA-18:	ARA-III Radionuclide Tank (ARA-736)
ARA-19:	ARA-II Detention Tank for Fuel Oil/Radionuclides (ARA-719)
ARA-20:	ARA-IV Test Area Contaminated Leach Pit No. 1
ARA-24:	ARA-III Windblown Soil
PBF-04:	PBF Control Area Oil Tank at PBF-608 (Substation) Outside PBF Fence
PBF-07:	PBF Reactor Area Oil Drum Storage (PER-T13)
PBF-19:	PBF SPERT-III Inactive Fuel Oil Tank (West Side of the Waste Experimental Reduction Facility)
PBF-24:	PBF SPERT-IV Blowdown Pit (Adjacent to PBF-716)
PBF-29:	PBF Reactor Area Abandoned Fuel Oil Tank
PBF-31:	SPERT-II Fuel Oil Tank (PBF-742)
PBF-32:	PBF Control Area Fuel Oil Tank (PBF-742)

Note: The site codes PBF-18 and PBF-23 were not assigned.

Table 16. Sites requiring institutional controls and 5-year reviews.

ARA-03:	ARA-I Lead Sheeting Pad Near ARA-627
ARA-06:	ARA-II Stationary Low-Power Reactor 1 Burial Ground
ARA-07:	ARA-II Seepage Pit to East (ARA-720A)
ARA-08:	ARA-II Seepage Pit to West (ARA-720B)
ARA-13:	ARA-III Sanitary Sewer Leach Field and Septic Tank (ARA-740)
ARA-21:	ARA-IV Test Area Septic Tank and Leach Pit No. 2
ARA-22:	ARA-IV Control Area Septic Tank and Leach Pit No. 3 (ARA-617)
PBF-01:	PBF Control Area Septic Tank (PBF-724) and Seepage Pit (PBF-735)
PBF-02:	PBF Control Area Septic Tanks (PBF-728 and PBF-739) and Seepage Pit (PBF-736)
PBF-03:	PBF Control Area Septic Tank for PBF-632 and Seepage Pits (PBF-745 and PBF-748)
PBF-05:	PBF Reactor Area Warm Waste Injection Well (PBF-301)
PBF-06:	PBF Reactor Area Blowdown Pit for Reactor Boiler by PBF-621
PBF-08:	PBF Reactor Area Corrosive Waste Disposal Sump Brine Tank
PBF-09:	PBF Reactor Area Septic Tank and Drain Field (PBF-728)
PBF-10:	PBF Reactor Area Evaporation Pond (PBF-733)
PBF-11:	PBF SPERT-I Seepage Pit (PBF-750)
PBF-12:	PBF SPERT-I Leach Pond
PBF-13:	PBF Reactor Area Rubble Pit
PBF-14:	PBF SPERT-II Inactive Fuel Oil Tank (Front of PBF-612)
PBF-15:	PBF Reactor Area Corrosive Waste Injection Well (PBF-302)
PBF-17:	PBF SPERT-II Septic Tank and Seepage Pit (PBF-725)
PBF-20:	PBF SPERT-III Small Leach Pond
PBF-21:	PBF SPERT-III Large Leach Pond
PBF-22:	PBF SPERT-IV Leach Pond (PBF-758)
PBF-25:	PBF SPERT-IV Septic Tank and Leach Pit (PBF-727 and PBF-757)
PBF-26:	PBF SPERT-IV Lake
PBF-27:	PBF SPERT-III Septic Tank (PBF-726) and Seepage Pit
PBF-28:	PBF Reactor Area Cooling Tower Area and Drainage Ditch
PBF-30:	PBF Reactor Area Abandoned Septic System

References

The following list of references is provided for readers who want more detailed information than is presented in this document. These materials are available in the INEEL Administrative Record. Paper copies can be reviewed at the locations listed in the margin of page 32.

The title of the primary source (see entry 1) has been shortened in subsequent entries for convenience.

1. *Waste Area Group 5 Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study*, January 1999, DOE/ID-10607 (Comprehensive Investigation Report)

2. *Agreement-in-Principle between the Shoshone-Bannock Tribes and the U.S. Department of Energy*, August 6, 1998

3. *Auxiliary Reactor Area-I Chemical Evaporation Pond Record of Decision*, December 1992, U.S. Department of Energy, Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare

4. *Stationary Low-Power Reactor-1 and Boiling Water Reactor Experiment-I Burial Grounds and 10 No Actions Sites Record of Decision*, January 1996, U.S. Department of Energy, Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare.

5. *Power Burst Facility Corrosive Waste Sump and Evaporation Pond Record of Decision*, September 1992, U.S. Department of Energy, Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare.

6. "Sole Source Designation of the Eastern Snake River Plain Aquifer, Southern Idaho; Final Determination," October 7, 1991, *Federal Register*, 56 FR 50634, U.S. Environmental Protection Agency

7. *Federal Facility Agreement and Consent Order for the Idaho National Engineering and Environmental Laboratory*, December 4, 1991, U.S. Department of Energy, Idaho Field Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare.

8. "Radioactive Waste Management," *DOE Order 5820.2A*

9. Comprehensive Investigation Report, Section 4

10. Comprehensive Investigation Report, Section 6

11. Comprehensive Investigation Report, Section 7

12. Comprehensive Investigation Report, Section 9.3

13. Comprehensive Investigation Report, Sections 11 and 12

14. Comprehensive Investigation Report, Sections 9 through 12

15. Comprehensive Investigation Report, Sections 9 through 12

16. Comprehensive Investigation Report, Sections 11 and 12

17. Comprehensive Investigation Report, Sections 11 and 12

18. Comprehensive Investigation Report, Sections 9 through 12

19. *Proposed Plan for Waste Area Group 1 – Test Area North, Idaho National Engineering and Environmental Laboratory*, November 1998

20. *Update Fact Sheet*, "Waste Area Group 5 environmental investigation nearly complete," January 1999

21. Comprehensive Investigation Report, Section 3

INFO INEEL environmental restoration documents can be obtained from the Information Repositories located in Idaho Falls, Boise, and Moscow (see page 32); from the Administrative Record on the Internet at **http://ar.inel.gov** or by calling the INEEL toll-free phone number 1-800-708-2680.

1(800)
708-2680

Public Involvement

INEEL Information Repositories

The INEEL Administrative Record is available to the public at the following locations:

INEEL Technical Library
DOE Public Reading Room
1776 Science Center Drive
Idaho Falls, ID 83415
208-526-1185

Albertsons Library
Boise State University
1910 University Drive
Boise, ID 83725
208-385-1621

University of Idaho Library
University of Idaho Campus
434 2nd Street
Moscow, ID 83843
208-885-6344

The Administrative Record may be accessed on the Internet by typing **http://ar.inel.gov** on the command line. Any library with the Internet can access the Administrative Record.

Public Involvement

Citizens are encouraged to get involved in decision-making at the INEEL by reviewing this proposed plan and related documents, attending a public meeting or briefing, and providing feedback to the Agencies or the INEEL Community Relations Office.

The documents referenced in this proposed plan, as well as other related documents, are available in the INEEL Administrative Record located in Idaho Falls, Boise, and Moscow (see sidebar for locations). The Administrative Record, as well as other INEEL Environmental Restoration and Power Burst Facility/Auxiliary Reactor Area WAG 5 information, is available via the Internet.

Public Meetings

Three public meetings will be held. Each meeting will follow the same format. From 6 to 7 p.m., Agency and project representatives will be available to discuss the WAG 5 investigation and proposed alternatives. At 7 p.m. there will be a formal presentation by the Agencies, followed by a question and answer session and an opportunity to provide comments. A court reporter will record public comments received and will prepare a transcript of the public meetings. Transcripts from the public meetings will be available in the Administrative Record.

Idaho Falls
Monday, May 17
Shilo Inn

Boise
Tuesday, May 18
Doubletree Downtown

Lewiston
Wednesday, May 19
Red Lion Hotel and Convention Center

Briefings for other communities can be arranged by calling the INEEL's toll-free number 800-708-2680.

MAY

Sun	Mon	Tue	Wed	Thu	Fri	Sat
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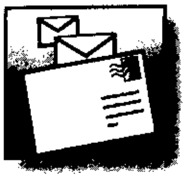
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	Idaho Falls **17**	Boise **18**	Lewiston **19**	20	21	22
23	24	25	26	27	28	29
30	31					



Written Comments

In addition to submitting comments at the public meetings, citizens can submit written comments by giving them to one of the project representatives at the public meetings. Written comments can also be mailed using the form included on this proposed plan or in another format. *Please note that the mailing address for comments has changed.* Comments sent to any other address may not be considered.

This proposed plan is also available on the Internet at **http://www.inel.gov/environment/em/pdf/pbfplan.pdf** as a portable data file (PDF). A link has been created from the electronic proposed plan to an on-line comment form, which can also be used to submit comments.

For More Information

Citizens can also request additional information or schedule a briefing by contacting the Agency representatives, the INEEL Community Relations representative for WAG 5, or by calling the INEEL toll-free number, 800-708-2680.

Kathleen E. Hain
Director
Environmental Restoration Program
U.S. Department of Energy
P.O. Box 1625
Idaho Falls, ID 83415-3911
208-526-4392

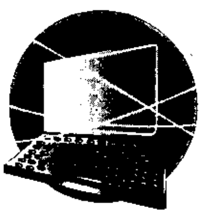
Wayne Pierre
U.S. Environmental Protection Agency, Region 10
1200 6th Avenue
Seattle, WA 98101
206-553-7261

Dean Nygard
Idaho Department of Health and Welfare
Division of Environmental Quality
1410 North Hilton
Boise, ID 83706
208-373-0285 or 800-232-4635

To request a briefing with project managers:

Call the INEEL Community Relations Plan Office, 208-526-4700 or the INEEL's toll-free number 800-708-2680

Contact Erik Simpson, INEEL Community Relations representative for WAG 5
INEEL Community Relations Office
P.O. Box 1625
Idaho Falls, ID 83415-3911
800-708-2680 or 208-526-4700
eas@inel.gov



INFO The INEEL Home Page is on the Internet at: **http://www.inel.gov**

The INEEL's Environmental Restoration information is on the Internet at:
http://www.inel.gov/environment/em

The INEEL Administrative Record is on the Internet at: **http://ar.inel.gov**

Summary of Preferred Alternatives

The following summary of the preferred alternatives for the WAG 5 sites is provided for the reader's assistance. The reader should consult the explanations provided in this document for more information on the preferred alternative and all other alternatives for each site. Additional information is available in the comprehensive investigation report.

	Site Name and Description	Description of Contamination	Preferred Alternative	Cost (millions)	Notes
CONTAMINATED SOIL SITES	**ARA-I Chemical Evaporation Pond (ARA-01)** Cost is the combined estimate for the remediation of all five contaminated soil sites.	Soil contaminated with **Selenium** **Thallium**	**Alternative 5a - Removal, Ex Situ Sorting, and Disposal on the INEEL**	**$ 13.8 to $ 19.6** depending on volume reduction	
	ARA-III Radioactive Waste Leach Pond (ARA-12) Cost is the combined estimate for the remediation of all five contaminated soil sites.	Soil contaminated with **Cesium-137** **Silver-108m** **Copper** **Mercury** **Selenium**			
	ARA-I and ARA-II Radiologically Contaminated Soils (ARA-23) Cost is the combined estimate for the remediation of all five contaminated soil sites.	Soil contaminated with **Cesium-137**			
	ARA-I Soils Beneath the ARA-626 Hot Cells (ARA-25) Cost is the combined estimate for the remediation of all five contaminated soil sites.	Soil contaminated with **Cesium-137** **Radium-226** **Arsenic** **Lead** **Copper**			
	SPERT-II Leach Pond (PBF-16) Cost is the combined estimate for the remediation of all five contaminated soil sites.	Soil contaminated with **Mercury**			
	ARA-I Sanitary Waste System (ARA-02) The residual sludge in the seepage pit is the only source of excess risk. However, remediation includes the removal and disposition of the entire system.	Sanitary waste system with a small quantity of sludge in the seepage pit contaminated with **Cesium-137** **Radium-226** **Uranium-235** **Uranium-238**	**Alternative 3a - Removal, Ex Situ Thermal Treatment, and Disposal**	**$ 2.0**	
	ARA-I Radionuclide Tank Site (ARA-16) The contaminated soil surrounding the tank is the only evaluated source of excess risk. However, remediation would include the tank and accompanying structure. An approved facility for treatment or disposal of the ARA-16 tank contents does not currently exist. The waste will be stored at the Radioactive Waste Management Complex until the Advanced Mixed Waste Treatment Facility is operational.	Soil contaminated with **Cesium-137** The radionuclide tank system and the mixed waste contained in the tank also will be remediated.	**Alternative 4a - Removal, Ex Situ Thermal Treatment, and Disposal**	**$ 4.4**	

WAG 5 Comments (continued)

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ENVIRONMENTAL RESTORATION PROGRAM
DOE IDAHO OPERATIONS OFFICE MS 3911
PO BOX 1625
IDAHO FALLS IDAHO 83403-9987

Please return this form by June 9, 1999

What's Your Opinion?

*The Agencies want to hear from you to decide what actions to take at WAG 5.**

WAG 5 Comments ____

** If you want a copy of the Record of Decision and Responsiveness Summary, make sure your mailing label is correct.*

INEEL Environmental Restoration Program
P.O. Box 1625
Idaho Falls, ID 83415-3911

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